TRANSPORTATION

PROJECT REPORT

DRAFT DESIGN REPORT / ENVIRONMENTAL IMPACT STATEMENT

Appendix F – Traffic Analysis

January 2014

Highway Project
P.I.N. 1721.51
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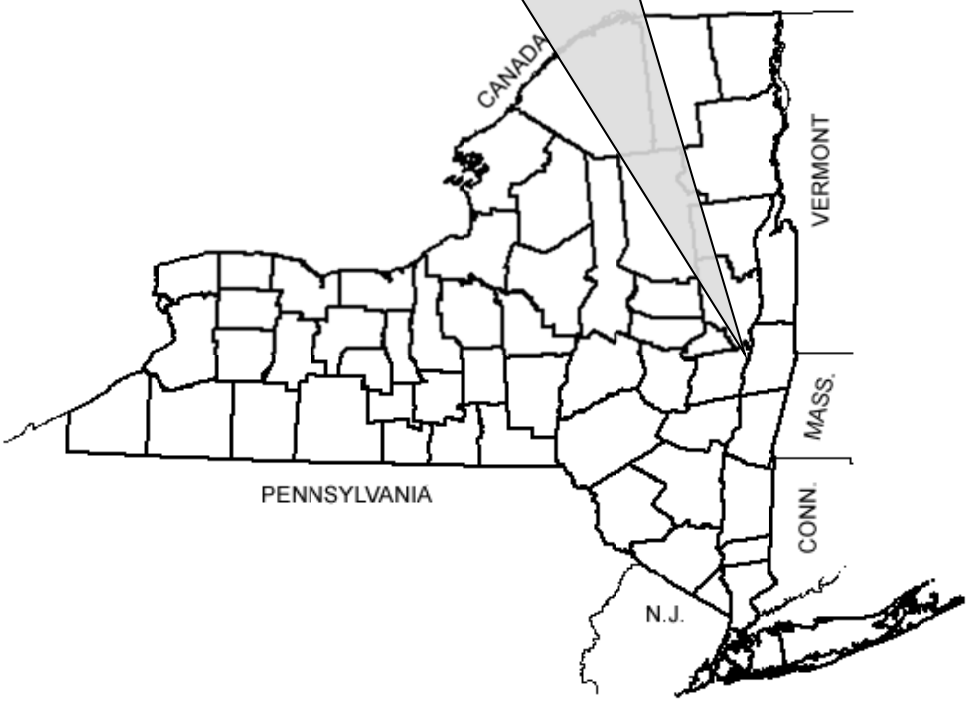
Interstate 87 (I-87) Exit 4 Access Improvements
Albany County



U.S. Department of Transportation Federal Highway Administration

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
ANDREW M. CUOMO, Governor JOAN MCDONALD, Commissioner

Traffic Analysis

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Traffic Analysis

The following discussion describes the traffic data used for this project and the methods used to analyze existing and future conditions. The exhibits that are also printed in the main body of the design report follow the design report naming convention. Exhibits unique to this appendix begin with the letter "F".

1.0 DESIGN YEAR

The following design years are used in accordance with the NYSDOT Project Development Manual Appendix 5:

- Existing (2009)
- Estimated time of completion (ETC) (2016)
- ETC + 10 years (2026)
- ETC + 20 years (2036)
- ETC + 30 years (2046) at intersections adjacent to bridge structures and freeway segment underpasses or overpasses

2.0 GROWTH RATES

Traffic volume projections for the project study area were conducted by the Capital District Transportation Committee (CDTC) using their regional travel demand model. CDTC is the designated Metropolitan Planning Organization (MPO) for the Albany-Schenectady-Troy-Saratoga metropolitan area. The model incorporates existing traffic counts, planned development and transportation projects, and growth projections to estimate future traffic volumes with and without the implementation of this project.

Since the volume projections derived from the regional demand model reflect changes associated with regional land use, demographics and travel, the resulting peak hour volumes do not represent a uniform growth rate applied throughout the project area network. In general, CDTC's volume projections show little to no growth for the No-Build scenario out to ETC+20. The growth and traffic diversions to the Exit 4 area vary for each of the Build Alternatives.

3.0 STUDY AREA

The traffic study area includes the project limits described in Section 1.2.1 of the design report. Within this study area, the following intersections and freeway facilities are included in the traffic operations evaluations:

Signalized Intersections:

- Central Avenue & Wolf Road
- Wolf Road & Sand Creek Road
- Wolf Road & Metro Park Road
- Wolf Road & I-87 Exit 4 northbound (NB) off-ramp
- Albany-Shaker Road & Wolf Road / I-87 Exit 4 NB on-ramp
- Albany-Shaker Road & Old Wolf Road / I-87 Exit 4 southbound (SB) on-ramp
- Old Wolf Road & I-87 Exit 4 SB off-ramp
- Watervliet-Shaker Road & I-87 Exit 5 SB off- and on-ramps
- Watervliet-Shaker Road & I-87 Exit 5 NB off- and on-ramps / Holly Lane

I-87 (Northway): All freeway segments, ramp junctions and weaves from Exit 2 to Exit 6.

4.0 TRAFFIC DATA

4.1 Traffic Speeds

The posted speed limit on I-87 within the project limits is 55 mph. The posted speed limit on Albany-Shaker Road, Wolf Road, Old Wolf Road, and Watervliet-Shaker Road within the project limits is 40 mph.

Actual operating speeds during the AM and PM peak hours were compiled from data provided by NYSDOT and by information published byNYSDOT Highway Data Services. The average speed and 85th percentile operating speeds (where available) within the study area are provided in Exhibit 2.3.1.5 b.

Exhibit 2.3.1.5 b
Existing Peak Hour Traffic Speeds (mph)

Roadway: Segment	Direction	Average		85th Percentile		Source[1]
		AM	PM	AM	PM	
I-87: Exit 2 to Exit 4	NB	57	51	-	-	A
	SB	56	56	-	-	
I-87: Exit 4 to Exit 5	NB	57	45	-	-	A
	SB	56	57	-	-	
I-87: Exit 5 to Exit 6	NB	52	41	-	-	A
	SB	56	56	-	-	
Albany-Shaker Road: Airport to Old Wolf Road	WB[2]	30	29	-	-	B
Wolf Road: Metro Park Road to Exit 4 NB off-ramp	NB	34	26	-	-	B
	SB	37	34	-	-	
Old Wolf Road: Exit 4 ramp to Old Niskayuna Road	NB	33	27	43	42	C
	SB	33	23	41	41	
Watervliet-Shaker Road: Exit 5 SB off-ramp to Exit 5 NB ramps	EB	27	23	-	-	B
	WB	35	34	-	-	

[1] Sources of speed data:
A. Continuous count stations via NYSDOT Region 1
B. Running speeds from travel time study
C. NYSDOT Highway Data Services

[2] Travel times were not measured in the eastbound direction from the Airport.

4.2 Travel Time & Delays

Field travel time data was collected in January 2009 on the study area roadways. Data was collected using the average-car method, where a vehicle is driven along the route traveling with traffic while distance, travel time and delay are recorded. The data collected was used as the basis for microsimulation modeling calibration (see Section 8.0).

Travel time and delay runs were conducted during the AM (7am to 9am) and PM (4pm to 6pm) peak hours. The study area was broken up into segments for the data collection. The sample size was nine to 15 runs in each direction on the local system (Wolf Road, Albany-Shaker Road, Old Wolf Road) and six to eight runs in each direction on I-87. The average travel time and delay collected from this study are summarized in Exhibit 2.3.1.5 a.

Exhibit 2.3.1.5 a Travel Time and Delay Summary				
Roadway: Segment	**AM**		**PM**	
	Overall Travel Time (seconds)	**Delay (seconds)**	**Overall Travel Time (seconds)**	**Delay (seconds)**
Northbound				
Wolf Road: Central to Metro Park	185	44	238	73
Wolf Road/ASR: Metro Park to Old Wolf	159	65	335	198
I-87: Sand Creek Overpass to Airport	414	144	403	102
Southbound				
WSR/CD Road/Old Wolf: Exit 5 NB Ramps to ASR	209	69	201	63
ASR/Wolf Rd: Old Wolf to Metro Park	104	18	92	5
Wolf Road: Metro Park to Central Ave	133	72	306	127
I-87: Exit 6 On-Ramp to Airport	206	52	303	35

The cause of the majority of the delay time experienced along the routes was related to traffic signal delay.

4.3 Traffic Volume Source

Existing AM and PM peak hour turning movement volumes were collected at many of the study area intersections in June and July of 2006 and January 2009. Traffic data was collected in years prior for the entire study area. The data collection conducted in 2009 was focused at key intersections in order to provide an update to data collected in 2006. All data collected in 2006 and 2009 was provided to CDTC to be used as a base in their regional demand model. Exhibit F.4.3-1 provides a summary of the data collection locations.

Exhibit F.4.3-1 Traffic Data Collection Locations		
Intersections	**2006**	**2009**
Wolf Road & Central Avenue	X	
Wolf Road & Sand Creek Road	X	X
Wolf Road & Metro Park Road	X	
Wolf Road & NB off-ramp	X	X
Albany-Shaker Road & Wolf Road	X	X
Albany-Shaker Road & Old Wolf Road	X	X
Old Wolf Road & Exit 4 SB off-ramp	X	
Watervliet-Shaker Road & Exit 5 SB Ramps		X
Watervliet-Shaker Road & Albany-Shaker Road	X	
Albany-Shaker Road & Airport Access	X	

The raw traffic count data from 2006 and 2009 is provided in Attachment B of this Appendix.

With the data collected as a base, CDTC forecasted volumes for a seasonally adjusted Existing (2009) condition, ETC (2016) No-Build, ETC+10 (2026) No-Build, ETC+20 (2036) No-Build and ETC+30 (2046) No-Build conditions.

4.4 Traffic Flow Diagrams

Exhibit 2.3.1.6 b presents the Existing (2009) traffic volumes for the study roadways. Exhibit F.4.4-1 presents the estimated future No-Build traffic volumes on these roadways for the four design horizons of the project. As shown in the exhibits, there is very little growth projected through the design years under the No-Build condition. The I-87 growth rates vary from 0.0% to 0.3% per year through ETC+30. The growth rates on the local system range from 0.1% to 1.1% per year through ETC+30.

The AM and PM peak hour traffic flow diagrams are presented in Attachment A of this Appendix. The AM and PM peak hours represent the periods of recurring peak hourly flows on the roadway network.
The Existing and No-Build turning movement volumes at study intersections are presented on Figures F-1 through F-10. The Existing and No-Build I-87 mainline and ramp volumes are presented on Figures F-11 through F-20. Note that the I-87 and ramp volumes do not balance all the way through the corridor. This was done to maintain the source data provided by CDTC for the freeway segments and ramps.

Exhibit 2.3.1.6 b
Existing Traffic Volumes

Roadway: Segment	Existing (2009)	
	AADT[1]	AM Peak PM Peak
I-87: Exit 2 to Exit 4 Northbound	56,700	3000 5100
I-87: Exit 4 to Exit 2 Southbound	56,700	5150 3750
I-87: Exit 4 to Exit 5 Northbound	64,400	2700 5800
I-87: Exit 5 to Exit 4 Southbound	48,900	4400 2500
I-87: Exit 5 to Exit 6 Northbound	66,700	2500 6000
I-87: Exit 6 to Exit 5 Southbound	67,800	6100 3300
Albany-Shaker Rd: West of Old Wolf	26,000	2300 2600
Wolf Rd: South of Exit 4	25,000	1950 2500

(1) AADT is the Average Annual Daily Traffic.

Exhibit F.4.4-1
Forecast No-Build Traffic Volumes

Roadway: Segment	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
	AADT[1]	AM Peak / PM Peak	AADT	AM Peak / PM Peak	AADT	AM Peak / PM Peak	AADT	AM Peak / PM Peak
I-87: Exit 2 to Exit 4 Northbound	56,700	3000 / 5100	57,200	3000 / 5150	57,800	3000 / 5200	58,300	3000 / 5250
I-87: Exit 4 to Exit 2 Southbound	57,800	5200 / 3850	58,300	5250 / 3950	58,900	5300 / 4100	59,400	5350 / 4250
I-87: Exit 4 to Exit 5 Northbound	65,600	2750 / 5900	66,100	2750 / 5950	66,700	2800 / 6050	67,200	2850 / 6050
I-87: Exit 5 to Exit 4 Southbound	48,900	4400 / 2550	49,400	4450 / 2600	50,000	4550 / 2750	50,600	4550 / 2800
I-87: Exit 5 to Exit 6 Northbound	67,800	2500 / 6100	68,300	2550 / 6150	69,400	2600 / 6250	-	- / -
I-87: Exit 6 to Exit 5 Southbound	67,800	6100 / 3450	67,200	6050 / 3650	67,200	6050 / 3800	-	- / -
Albany-Shaker Rd: West of Old Wolf	33,000	2450 / 3300	35,000	2550 / 3500	37,500	2600 / 3750	39,500	2800 / 3950
Wolf Rd: South of Exit 4	20,000	2050 / 2000	21,000	2000 / 2100	22,500	2000 / 2250	-	- / -

(1) AADT is the Average Annual Daily Traffic.

5.0 TRAFFIC CHANGES DUE TO BUILD ALTERNATIVES

Two feasible alternatives were evaluated: Diamond Alternative and Flyover Alternative. Refer to Section 3.2 for descriptions of the alternatives. As stated previously, CDTC used their regional demand model to estimate future traffic volumes for the project study area with and without the project alternatives. For the build alternatives, they incorporated the proposed connections and geometry into the roadway network to establish the traffic patterns.

5.1 Diamond Alternative

There are several elements of the Diamond Alternative that will change the existing traffic patterns:

- Existing elements removed
    - Exit 4 SB off-ramp
    - Exit 5 SB on-ramp
    - C-D road between Exits 5 and 4
    - Exit 4 SB on-ramp
    - Exit 4 NB off-ramp
    - Exit 4 NB on-ramp
- New ramp facilities
    - Exit 5 SB on-ramp from Watervliet-Shaker Road (creating a “diamond” configuration with the Exit 5 SB off-ramp)
    - Exit 4 NB and SB on- and off-ramps to a new connector road (creating a new “diamond” interchange
- New roadway
    - Connector Road from Wolf Road at Metro Park Road to Albany-Shaker Road (crossing over I-87)

All of these modifications to the existing system change the traffic patterns on segments of I-87 and the local roadway system. The addition of the Connector Road and Exit 4 Diamond ramps change patterns on the Exit 2 and Exit 5 ramps, especially for those with Wolf Road origins or destinations.

The AM and PM peak hour traffic flow diagrams are presented in Attachment A of this Appendix. The turning movement volumes at study intersections are presented on Figures F-21 through F-28. The Existing and No-Build I-87 mainline and ramp volumes are presented on Figures F-29 through F-36.

Compared to the No-Build condition, the Diamond Alternative is estimated to divert approximately 400 vehicles in the AM and 1,100 vehicles in the PM to the study area roadways from other roadways. This is a result of better access to the Airport, reduced congestion and shorter duration trips.

Exhibit F.5.1-1 presents the projected ETC (2016), ETC+10 (2026), ETC+20(2036), and ETC+30 (2046) Diamond Alternative traffic volumes for the study area. The Diamond Alternative sustains slight growth on I-87 at 0.5% per year or less.

Exhibit F.5.1-1 Forecast Build Alternative Traffic Volumes Diamond Alternative								
Roadway: Segment	**ETC (2016)**		**ETC+10 (2026)**		**ETC+20 (2036)**		**ETC+30 (2046)**	
	AADT[1]	**AM Peak** **PM Peak**	**AADT**	**AM Peak** **PM Peak**	**AADT**	**AM Peak** **PM Peak**	**AADT**	**AM Peak** **PM Peak**
I-87: Exit 2 to Exit 4 NB	60,000	3300 5400	60,600	3500 5450	61,100	3650 5500	61,100	3650 5500
I-87: Exit 4 to Exit 2 SB	57,800	5200 3850	58,300	5250 3950	58,900	5300 4050	59,400	5350 4050
I-87: Exit 4 to Exit 5 NB	62,800	2500 5650	63,300	2600 5700	63,900	2650 5750	64,400	2650 5800
I-87: Exit 5 to Exit 4 SB	59,400	5350 3650	62,200	5600 3800	65,000	5850 3900	65,000	5850 3900
I-87: Exit 5 to Exit 6 Northbound	63,900	2400 5750	65,600	2550 5900	67,200	2550 6050	-	- -
I-87: Exit 6 to Exit 5 Southbound	67,800	6100 3500	68,900	6200 3625	70,000	6300 3750	-	- -
Albany-Shaker Rd: West of Old Wolf	18,000	1100 1800	18,500	1250 1850	19,500	1400 1950	20,000	1600 2000
Wolf Rd: South of Exit 4	14,000	900 1400	15,000	950 1500	16,500	1050 1650	-	- -

(1) AADT is the Average Annual Daily Traffic.

5.2 Flyover Alternative

There are several elements of the Flyover Alternative that will change the existing traffic patterns:

- Existing elements removed
  - Exit 4 SB off-ramp
  - Exit 5 SB on-ramp
  - C-D road between Exits 5 and 4
  - Exit 4 SB on-ramp
- Existing elements modified
  - Exit 4 NB off-ramp restricted to right-turn only onto Wolf Road SB
- New ramp facilities
  - Exit 4 NB off-ramp to new intersection on Albany-Shaker Road
  - Exit 5 SB on-ramp relocated to north (creates “half-diamond” with SB off-ramp)
  - Exit 4 SB off-ramp to new intersection on Albany-Shaker Road
  - Exit 4 SB on-ramp, accessed from new intersection on Albany-Shaker Road

All of these modifications to the existing system change the traffic patterns on segments of I-87 and the local roadway system. The removal of the C-D road and the Exit 4 SB off-ramp to Old Wolf Road significantly reduces the volumes on Old Wolf Road. Providing ramps to the new intersection on Albany-Shaker Road reduces the number of intersections that vehicles destined for Albany International Airport have to drive through.

The AM and PM peak hour traffic flow diagrams for this alternative are presented in Attachment A of this Appendix. The turning movement volumes at study intersections are presented on Figures F-37 through F-44 and the I-87 mainline and ramp volumes are presented on Figures F-45 through F-52.

Compared to the No-Build condition, the alternative is estimated to divert approximately 100 vehicles in the AM and 900 vehicles in the PM to the study area roadways from other roadways. This is a result of better access to the Airport, reduced congestion and shorter duration trips.

Exhibit F.5.2-1 presents the projected traffic volumes for the Flyover Alternative for each of the project's design-year horizons. The Flyover Alternative sustains slight growth on I-87 at 0.5% per year or less.

Exhibit F.5.2-1
Forecast Build Alternative Traffic Volumes
Flyover Alternative

Roadway: Segment	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
	AADT[1]	AM Peak / PM Peak	AADT	AM Peak / PM Peak	AADT	AM Peak / PM Peak	AADT	AM Peak / PM Peak
I-87: Exit 2 to Exit 4 NB	61,100	3250 / 5500	62,200	3350 / 5600	62,800	3500 / 5650	63,300	3550 / 5700
I-87: Exit 4 to Exit 2 SB	59,400	5350 / 3900	60,000	5400 / 4000	60,600	5450 / 4150	61,100	5500 / 4100
I-87: Exit 4 to Exit 5 NB	65,600	2700 / 5900	66,100	2750 / 5950	66,100	2800 / 5950	66,100	2800 / 5950
I-87: Exit 5 to Exit 4 SB	58,900	5300 / 3650	62,200	5600 / 3800	65,000	5850 / 3900	65,000	5850 / 3900
I-87: Exit 5 to Exit 6 Northbound	68,300	2550 / 6150	68,600	2600 / 6175	68,900	2650 / 6200	-	- / -
I-87: Exit 6 to Exit 5 Southbound	66,700	6000 / 3500	67,800	6100 / 3650	68,300	6150 / 3800	-	- / -
Albany-Shaker Rd: West of Old Wolf	19,000	1800 / 1900	20,500	2000 / 2050	22,000	2200 / 2200	24,500	2300 / 2450
Wolf Rd: South of Exit 4	18,500	1600 / 1850	19,000	1700 / 1900	19,500	1800 / 1950	20,500	1950 / 2050

(1) AADT is the Average Annual Daily Traffic.

6.0 TRUCK TRAFFIC

Heavy vehicle (truck) traffic for the study area roadways and intersections was compiled and used in the VISSIM and HCS analyses. Exhibit F.6.0-1 provides a summary of the truck percentages used. Daily truck percentage was not available for Wolf Road.

Exhibit F.6.0-1
Truck Data

Route	I-87	Albany-Shaker Rd	Wolf Rd
% Peak Hour Trucks	2% AM, 2% PM	3% AM, 2% PM	1% AM, 1% PM
% Daily Trucks	8%	7%	-

7.0 ANALYSIS

A VISSIM microsimulation model was used to analyze the study area roadway network. The model was used to evaluate travel times, intersection delays and overall network delay. The LOS applied to the intersections are based on the criteria set forth in the 2000 Highway Capacity Manual (HCM) published by the Transportation Research Board (TRB). Freeway and ramp junction LOS were evaluated using Highway Capacity Software (HCS). LOS criteria from the HCM are provided in Attachment D of this Appendix.

8.0 CALIBRATION

The Existing condition VISSIM model was calibrated to field conditions in order to provide a base model from which all future No-Build and Build alternative models could be developed. This calibration involved

a program of field samples of applicable observable metrics such as vehicle queuing, volumes and travel times. Model attributes and input variables were developed to replicate operations based on these field conditions.

8.1 Field Data Collection

In January 2009, turning movement traffic counts were conducted at key intersections within the study area to update data that was collected in 2006. Traffic counts were conducted during the weekday morning and evening peak periods of 7 am to 9 am and 4 pm to 6pm. While the turning movement counts were conducted, spot queue length observations were also taken to establish the average and max queue lengths at the intersections.

Travel times through the study area were also collected, as described and presented in Section 4.2. The travel time data collection was broken up between for five different segments of the study area. Times were also recorded at intersections along the route in order to provide the time between intersections and the delay experienced.

Existing roadway and intersection geometry was documented as well as traffic control devices. Traffic signal timing and phasing records were obtained from NYSDOT for the signalized intersections within the project study area.

8.2 Model Calibration

The data collected was used as a basis to calibrate the base model to replicate existing conditions. The field collected volumes, geometry and traffic control devices were input into the model. Travel times were collected from the model for the same limits and segments as was collected in the field.

In order to replicate existing conditions on congested roadways and ramps, driving behavior parameters had to be customized from the standard default values for some parts of the study area. Parameters such as look ahead/back distance, headway time, maximum deceleration, safety distance and waiting time before diffusion were adjusted to replicate the more aggressive driving behaviors in these areas. Speeds were also adjusted to match the existing speeds of vehicles entering and exiting the network. Information from the travel time field samples as well as posted speeds were used to determine appropriate speeds for the network, especially in areas where congestion is experienced outside of the modeled network but results in slowdowns within the modeled network. Speed reductions were used on roadway segments that contain multiple mid-block driveways and/or other traffic signals that were not included in the study. A model seeding interval of 550 seconds was utilized to ensure that the entire network is populated with vehicles prior to the evaluation of the peak hour.

An FHWA publication, *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*, provides some guidance on calibration targets. A summary of these targets is shown in Attachment C. For this model, a target of 10% variation from the field collected travel time for each overall run was used, which is a more refined calibration than the FHWA guidance (15%).

Exhibits F.8.2-1 and F.8.2-2 summarize the comparison between the field collected travel times and the times extracted from the calibrated VISSIM models. As shown, the travel times in the models are all within the 10% variation target from the field collected times.

Exhibit F.8.2-1
VISSIM Calibration Results
AM Peak Travel Time Calibration

Travel Time Segment	Field Time *	Model Time *	% Difference
Northbound			
Wolf Road: Central to Sand Creek	119	114	
Wolf Road: Sand Creek to Metro Park	66	63	
Wolf Road: Central to Metro Park	**185**	**177**	**-4.6%**
Wolf Road: Metro Park to Exit 4 NB Off	63	64	
Wolf Road: Exit 4 NB Off to ASR	57	40	
ASR: Wolf to Old Wolf	39	45	
Wolf Road/ASR: Metro Park to Old Wolf	**159**	**154**	**-3.4%**
I-87: Sand Creek Overpass to Exit 4 NB Off-Ramp	154	180	
Wolf Road: Exit 4 NB Off to ASR	57	40	
ASR: Wolf to Old Wolf	39	45	
ASR: Old Wolf to Airport	116	110	
I-87: Sand Creek Overpass to Airport	**414**	**428**	**3.4%**
Southbound			
WSR: Exit 5 NB Ramps to SB Ramps	39	49	
CD Road: Exit 5 SB Ramps to Old Wolf	83	73	
Old Wolf Road: CD Road to ASR	86	80	
WSR/CD Road/Old Wolf: Exit 5 NB Ramps to ASR	**209**	**208**	**-0.6%**
ASR: Old Wolf to Wolf	22	36	
Wolf Road: ASR to Exit 4 NB Off Ramp	33	17	
Wolf Road: Exit 4 NB Off to Metro Park	49	53	
ASR/Wolf Road: Old Wolf to Metro Park	**104**	**106**	**1.8%**
Wolf Road: Metro Park to Sand Creek	92	95	
Wolf Road: Sand Creek to Central	121	115	
Wolf Road: Metro Park to Central	**213**	**211**	**-1.0%**
I-87/CD Road: Exit 6 to Old Wolf	145	148	
Old Wolf Road: CD Road to ASR	86	80	
ASR: Old Wolf to Airport	122	110	
I-87: Exit 6 On-Ramp to Airport	**326**	**341**	**4.5%**

** Travel Time provided in seconds.*

Exhibit F.8.2-2
VISSIM Calibration Results
PM Peak Travel Time Calibration

Travel Time Segment	Field Time *	Model Time *	% Difference
Northbound			
Wolf Road: Central to Sand Creek	148	146	
Wolf Road: Sand Creek to Metro Park	91	86	
Wolf Road: Central to Metro Park	**238**	**232**	**-2.4%**
Wolf Road: Metro Park to Exit 4 NB Off	202	161	
Wolf Road: Exit 4 NB Off to ASR	111	91	
ASR: Wolf to Old Wolf	43	42	
Wolf Road/ASR: Metro Park to Old Wolf	**335**	**311**	**-7.0%**
I-87: Sand Creek Overpass to Exit 4 NB Off-Ramp	154	166	
Wolf Road: Exit 4 NB Off to ASR	111	91	
ASR: Wolf to Old Wolf	43	42	
ASR: Old Wolf to Airport	132	101	
I-87: Sand Creek Overpass to Airport	**403**	**403**	**-0.1%**
Southbound			
WSR: Exit 5 NB Ramps to SB Ramps	53	57	
CD Road: Exit 5 SB Ramps to Old Wolf	76	69	
Old Wolf Road: CD Road to ASR	71	96	
WSR/CD Road/Old Wolf: Exit 5 NB Ramps to ASR	**201**	**211**	**5.1%**
ASR: Old Wolf to Wolf	19	33	
Wolf Road: ASR to Exit 4 NB Off Ramp	18	15	
Wolf Road: Exit 4 NB Off to Metro Park	56	52	
ASR/Wolf Road: Old Wolf to Metro Park	**92**	**99**	**8.1%**
Wolf Road: Metro Park to Sand Creek	125	124	
Wolf Road: Sand Creek to Central	181	180	
Wolf Road: Metro Park to Central	**306**	**305**	**-0.4%**
I-87/CD Road: Exit 6 to Old Wolf	129	144	
Old Wolf Road: CD Road to ASR	71	96	
ASR: Old Wolf to Airport	121	101	
I-87: Exit 6 On-Ramp to Airport	**303**	**328**	**8.2%**

** Travel Time provided in seconds.*

9.0 LEVEL OF SERVICE CRITERIA

LOS is presented as a letter from A to F with A representing free flowing, unimpeded traffic with little or no delay and F representing highly congested traffic flow with long delays.

Standard design objectives for urban street systems is to achieve a LOS D on all intersection approaches during peak hours (NYSDOT Highway Design Manual, Chapter 5.9.2). However, it is recognized that there are many competing objectives and considerations, especially in urban areas, that may affect the desirability and feasibility of achieving this goal for peak hours. In these cases, peak-hour LOS E or F may be acceptable.

10.0 LEVEL OF SERVICE, TRAVEL TIME AND DELAYS

10.1 Existing and No-Build

10.1.1 Intersection Level of Service

Summaries of the LOS for the Existing and future No-Build conditions are presented in Exhibits F.10.1.1-1 through F.10.1.1-10. As shown in these analyses, the following study area intersections have one or more movement that experience LOS E or worse during the Existing studied peak hours:

- Central Avenue & Wolf Road (PM)
- Sand Creek Road & Wolf Road (PM)
- Exit 4 NB off-ramp & Wolf Road (AM & PM)
- Albany-Shaker Road & Wolf Road (AM & PM)
- Albany-Shaker Road & Old Wolf Road (AM & PM)
- Old Wolf Road & C-D Road (AM)

The intersections experience higher delay levels during the PM peak hour as volumes are higher on Wolf Road and at the intersections.

Delay is estimated to increase through the ETC+20 design horizon due to background traffic growth. For the ETC+20 No-Build condition, the following study area intersections will experience LOS E or worse for one or more movements during the studied peak hours:

- Central Avenue & Wolf Road (PM)
- Sand Creek Road & Wolf Road (PM)
- Exit 4 NB off-ramp & Wolf Road (AM & PM)
- Albany-Shaker Road & Wolf Road (PM)
- Albany-Shaker Road & Old Wolf Road (AM & PM)
- Old Wolf Road & C-D Road (AM)
- Exit 5 SB Ramps & Watervliet-Shaker Road (PM)

The LOS for some improvements improved at the intersection of Albany-Shaker Road & Wolf Road when comparing Existing to No-Build. This is related to the change in volume distribution at the intersection due to the opening of the final phase of the Wolf Road parallel connector road, which will create a connection from Albany-Shaker Road to Aviation Road.

Exhibit F.10.1.1-1
VISSIM Analysis Results
Intersection Level of Service
2009 Existing AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	39.9	D
	EB TT	19.5	B
Central Avenue	WB TTT	38.5	D
	WB R	7.4	A
Exit 2 NB Off-Ramp	NB TTT	40.2	D
Wolf Road	SB LL	46.6	D
	SB RR	5.9	A
OVERALL		**29.2**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	33.7	C
	EB T	32.6	C
	EB R	4.3	A
Sand Creek Road	WB L	39.1	D
	WB T	37.7	D
	WB R	6.8	A
Wolf Road	NB L	47.4	D
	NB TT	21.9	C
	NB R	7.8	A
Wolf Road	SB L	46.7	D
	SB TT	21.8	C
	SB R	5.7	A
OVERALL		**25.8**	**C**
Metro Park & Wolf Road			
Hess Station	EB L/T/R	26.6	C
Metro Park Drive	WB L	36.1	D
	WB T/R	8.1	A
Wolf Road	NB L	3.0	A
	NB TT	3.2	A
	NB R	3.7	A
Wolf Road	SB L	9.9	A
	SB TT/R	4.5	A
OVERALL		**5.7**	**A**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	76.6	E
	EB R	31.4	C
Wolf Road	NB TTT	11.7	B
	SB TT	6.7	A
OVERALL		**26.0**	**C**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	32.2	C
	EB TT/R	32.7	C
	EB R	17.2	B
Albany Shaker Road	WB L	51.4	D
	WB TT	25.9	C
	WB R	5.3	A
Wolf Road	NB L	64.4	E
	NB L/TT	41.4	D
	NB R	19.0	B
OVERALL		**32.3**	**C**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	43.2	D
	EB TT	43.6	D
	EB R	26.9	C
Albany Shaker Road	WB L	29.2	C
	WB TT/R	40.2	D
Old Wolf Road	SB LL/T	56.8	E
	SB R	49.4	D
OVERALL		**44.3**	**D**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	9.9	A
CD Road	WB L/T/R	34.7	C
Old Wolf Road	NB L/T/R	37.5	D
Old Wolf Road	SB L/T/R	64.3	E
OVERALL		**39.2**	**D**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	15.4	B
Watervliet Shaker Road	WB LT	16.6	B
Exit 5 SB Off-Ramp	SB L	24.3	C
	SB T/R	14.5	B
Sherwood Drive	SB L/T/R	24.9	C
OVERALL		**17.6**	**B**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	19.6	B
	EB T/R	6.3	A
Watervliet Shaker Road	WB L	12.9	B
	WB TT/R	12.1	B
Holly Lane	NB L/T/R	34.6	C
Exit 5 NB Off-Ramp	SB L	22.7	C
	SB T/R	10.4	B
OVERALL		**13.0**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-2
VISSIM Analysis Results
Intersection Level of Service
2009 Existing PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	55.5	E
	EB TT	20.3	C
Central Avenue	WB TTT	40.5	D
	WB R	19.3	B
Exit 2 NB Off-Ramp	NB TTT	54.3	D
Wolf Road	SB LL	63.7	E
	SB RR	27.6	C
OVERALL		**36.6**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	110.8	F
	EB T	98.2	F
	EB R	49.8	D
Sand Creek Road	WB L	64.4	E
	WB T	67.9	E
	WB R	16.3	B
Wolf Road	NB L	65.0	E
	NB TT	36.7	D
	NB R	13.8	B
Wolf Road	SB L	70.9	E
	SB TT	37.9	D
	SB R	19.0	B
OVERALL		**54.1**	**D**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	36.0	D
Metro Park Drive	WB L	43.5	D
	WB T/R	22.8	C
Wolf Road	NB L	10.1	B
	NB TT	14.2	B
	NB R	9.5	A
Wolf Road	SB L	26.1	C
	SB TT/R	6.0	A
OVERALL		**14.4**	**B**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	107.9	F
	EB R	19.8	B
Wolf Road	NB TTT	100.6	F
	SB TT	4.1	A
OVERALL		**68.6**	**E**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	92.8	F
	EB TT/R	50.4	D
	EB R	19.6	B
Albany Shaker Road	WB L	55.6	E
	WB T T	41.3	D
	WB R	27.0	C
Wolf Road	NB L	57.6	E
	NB L/TT	62.4	E
	NB R	36.2	D
OVERALL		**48.9**	**D**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	128.9	F
	EB TT	119.6	F
	EB R	108.5	F
Albany Shaker Road	WB L	84.1	F
	WB TT/R	27.8	C
Old Wolf Road	SB LL/T	76.4	E
	SB R	49.9	D
OVERALL		**80.3**	**F**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	6.3	A
CD Road	WB L/T/R	34.7	C
Old Wolf Road	NB L/T/R	14.4	B
Old Wolf Road	SB L/T/R	39.1	D
OVERALL		**31.6**	**C**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	34.0	C
Watervliet Shaker Road	WB LT	21.2	C
Exit 5 SB Off-Ramp	SB L	33.6	C
	SB T/R	6.1	A
Sherwood Drive	SB L/T/R	38.7	D
OVERALL		**28.4**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	30.6	C
	EB T/R	9.1	A
Watervliet Shaker Road	WB L	19.1	B
	WB TT/R	19.6	B
Holly Lane	NB L/T/R	42.2	D
Exit 5 NB Off-Ramp	SB L	32.5	C
	SB T/R	10.5	B
OVERALL		**21.4**	**C**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-3
VISSIM Analysis Results
Intersection Level of Service
2016 (ETC) No-Build AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	40.4	D
	EB TT	20.5	C
Central Avenue	WB TTT	38.6	D
	WB R	8.8	A
Exit 2 NB Off-Ramp	NB TTT	40.4	D
Wolf Road	SB LL	47.5	D
	SB RR	7.0	A
OVERALL		**29.2**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	31.1	C
	EB T	28.1	C
	EB R	2.4	A
Sand Creek Road	WB L	35.8	D
	WB T	32.0	C
	WB R	5.2	A
Wolf Road	NB L	42.9	D
	NB TT	13.1	B
	NB R	6.1	A
Wolf Road	SB L	47.9	D
	SB TT	19.7	B
	SB R	9.8	A
OVERALL		**20.4**	**C**
Metro Park & Wolf Road			
Hess Station	EB L/T/R	33.9	C
Metro Park Drive	WB L	42.9	D
	WB T/R	9.3	A
Wolf Road	NB L	3.3	A
	NB TT	2.0	A
	NB R	3.9	A
Wolf Road	SB L	4.5	A
	SB TT/R	2.9	A
OVERALL		**3.7**	**A**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	56.4	E
	EB R	16.6	B
Wolf Road	NB TTT	11.6	B
	SB TT	9.1	A
OVERALL		**20.5**	**C**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	41.7	D
	EB TT/R	23.0	C
	EB R	12.7	B
Albany Shaker Road	WB L	33.8	C
	WB TT	22.2	C
	WB R	5.2	A
Wolf Road	NB L	51.4	D
	NB L/TT	38.5	D
	NB R	7.9	A
OVERALL		**25.1**	**C**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	47.4	D
	EB TT	45.5	D
	EB R	32.8	C
Albany Shaker Road	WB L	67.2	E
	WB TT/R	24.4	C
Old Wolf Road	SB LL/T	81.6	F
	SB R	66.9	E
OVERALL		**50.7**	**D**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	8.9	A
CD Road	WB L/T/R	70.0	E
Old Wolf Road	NB L/T/R	42.9	D
Old Wolf Road	SB L/T/R	243.3	F
OVERALL		**92.1**	**F**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	16.4	B
Watervliet Shaker Road	WB LT	18.8	B
Exit 5 SB Off-Ramp	SB L	24.5	C
	SB T/R	13.8	B
Sherwood Drive	SB L/T/R	25.8	C
OVERALL		**19.3**	**B**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	20.2	C
	EB T/R	10.4	B
Watervliet Shaker Road	WB L	10.7	B
	WB TT/R	12.2	B
Holly Lane	NB L/T/R	30.7	C
Exit 5 NB Off-Ramp	SB L	23.3	C
	SB T/R	10.7	B
OVERALL		**13.6**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-4
VISSIM Analysis Results
Intersection Level of Service
2016 (ETC) No-Build PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	55.0	D
	EB TT	19.5	B
Central Avenue	WB TTT	43.6	D
	WB R	18.8	B
Exit 2 NB Off-Ramp	NB TTT	54.0	D
Wolf Road	SB LL	58.1	E
	SB RR	27.3	C
OVERALL		**37.4**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	128.3	F
	EB T	101.5	F
	EB R	55.0	D
Sand Creek Road	WB L	158.4	F
	WB T	170.3	F
	WB R	90.0	F
Wolf Road	NB L	68.4	E
	NB TT	36.5	D
	NB R	14.4	B
Wolf Road	SB L	66.3	E
	SB TT	36.8	D
	SB R	19.0	B
OVERALL		**71.0**	**E**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	40.6	D
Metro Park Drive	WB L	48.9	D
	WB T/R	38.1	D
Wolf Road	NB L	25.0	C
	NB TT	28.8	C
	NB R	25.8	C
Wolf Road	SB L	11.7	B
	SB TT/R	5.2	A
OVERALL		**21.0**	**C**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	80.5	F
	EB R	7.6	A
Wolf Road	NB TTT	182.9	F
	SB TT	6.4	A
OVERALL		**105.6**	**F**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	132.3	F
	EB TT/R	27.0	C
	EB R	10.1	B
Albany Shaker Road	WB L	24.5	C
	WB T T	36.8	D
	WB R	33.2	C
Wolf Road	NB L	67.4	E
	NB L/TT	72.3	E
	NB R	12.9	B
OVERALL		**48.5**	**D**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	416.1	F
	EB TT	330.6	F
	EB R	242.7	F
Albany Shaker Road	WB L	85.6	F
	WB TT/R	31.4	C
Old Wolf Road	SB LL/T	70.0	E
	SB R	46.1	D
OVERALL		**149.7**	**F**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	6.3	A
CD Road	WB L/T/R	27.0	C
Old Wolf Road	NB L/T/R	14.2	B
Old Wolf Road	SB L/T/R	27.5	C
OVERALL		**24.4**	**C**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	43.2	D
Watervliet Shaker Road	WB LT	22.8	C
Exit 5 SB Off-Ramp	SB L	34.2	C
	SB T/R	22.0	C
Sherwood Drive	SB L/T/R	43.9	D
OVERALL		**32.1**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	27.0	C
	EB T/R	10.0	B
Watervliet Shaker Road	WB L	14.1	B
	WB TT/R	19.2	B
Holly Lane	NB L/T/R	41.0	D
Exit 5 NB Off-Ramp	SB L	31.0	C
	SB T/R	10.0	A
OVERALL		**20.3**	**C**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-5
VISSIM Analysis Results
Intersection Level of Service
2026 (ETC+10) No-Build AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	41.8	D
	EB TT	21.0	C
Central Avenue	WB TTT	39.5	D
	WB R	9.0	A
Exit 2 NB Off-Ramp	NB TTT	40.4	D
Wolf Road	SB LL	46.6	D
	SB RR	7.0	A
OVERALL		**29.6**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	31.1	C
	EB T	28.0	C
	EB R	2.5	A
Sand Creek Road	WB L	37.5	D
	WB T	32.9	C
	WB R	5.1	A
Wolf Road	NB L	44.9	D
	NB TT	14.4	B
	NB R	6.6	A
Wolf Road	SB L	52.0	D
	SB TT	20.5	C
	SB R	9.4	A
OVERALL		**21.3**	**C**
Metro Park & Wolf Road			
Hess Station	EB L/T/R	33.7	C
Metro Park Drive	WB L	39.5	D
	WB T/R	7.9	A
Wolf Road	NB L	2.9	A
	NB TT	2.1	A
	NB R	4.3	A
Wolf Road	SB L	5.0	A
	SB TT/R	3.1	A
OVERALL		**4.0**	**A**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	58.4	E
	EB R	18.1	B
Wolf Road	NB TTT	12.1	B
	SB TT	8.6	A
OVERALL		**21.4**	**C**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	32.2	C
	EB TT/R	22.6	C
	EB R	12.3	B
Albany Shaker Road	WB L	31.4	C
	WB TT	22.2	C
	WB R	5.2	A
Wolf Road	NB L	52.0	D
	NB L/TT	37.4	D
	NB R	8.3	A
OVERALL		**24.4**	**C**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	46.3	D
	EB TT	44.1	D
	EB R	31.4	C
Albany Shaker Road	WB L	71.9	E
	WB TT/R	25.8	C
Old Wolf Road	SB LL/T	81.5	F
	SB R	70.9	E
OVERALL		**51.4**	**D**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	8.9	A
CD Road	WB L/T/R	73.9	E
Old Wolf Road	NB L/T/R	46.6	D
Old Wolf Road	SB L/T/R	262.3	F
OVERALL		**102.8**	**F**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	16.1	B
Watervliet Shaker Road	WB LT	18.2	B
Exit 5 SB Off-Ramp	SB L	26.7	C
	SB T/R	15.7	B
Sherwood Drive	SB L/T/R	26.4	C
OVERALL		**19.5**	**B**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	22.4	C
	EB T/R	10.9	B
Watervliet Shaker Road	WB L	10.8	B
	WB TT/R	14.1	B
Holly Lane	NB L/T/R	37.4	D
Exit 5 NB Off-Ramp	SB L	23.6	C
	SB T/R	11.3	B
OVERALL		**15.0**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-6
VISSIM Analysis Results
Intersection Level of Service
2026 (ETC+10) No-Build PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	55.7	E
	EB TT	20.1	C
Central Avenue	WB TTT	47.8	D
	WB R	23.1	C
Exit 2 NB Off-Ramp	NB TTT	55.0	D
Wolf Road	SB LL	63.5	E
	SB RR	29.8	C
OVERALL		**40.1**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	130.9	F
	EB T	111.9	F
	EB R	64.6	E
Sand Creek Road	WB L	183.9	F
	WB T	197.0	F
	WB R	112.8	F
Wolf Road	NB L	70.5	E
	NB TT	41.4	D
	NB R	20.4	C
Wolf Road	SB L	67.9	E
	SB TT	37.0	D
	SB R	19.1	B
OVERALL		**76.9**	**E**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	41.6	D
Metro Park Drive	WB L	49.4	D
	WB T/R	35.0	C
Wolf Road	NB L	41.0	D
	NB TT	44.6	D
	NB R	39.4	D
Wolf Road	SB L	13.3	B
	SB TT/R	5.3	A
OVERALL		**29.9**	**C**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	86.0	F
	EB R	8.0	A
Wolf Road	NB TTT	193.7	F
	SB TT	6.0	A
OVERALL		**111.0**	**F**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	132.4	F
	EB TT/R	30.4	C
	EB R	11.2	B
Albany Shaker Road	WB L	27.2	C
	WB T T	39.5	D
	WB R	40.2	D
Wolf Road	NB L	67.6	E
	NB L/TT	73.4	E
	NB R	12.7	B
OVERALL		**49.8**	**D**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	510.2	F
	EB TT	420.7	F
	EB R	358.8	F
Albany Shaker Road	WB L	88.3	F
	WB TT/R	32.4	C
Old Wolf Road	SB LL/T	73.9	E
	SB R	49.4	D
OVERALL		**190.0**	**F**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	6.4	A
CD Road	WB L/T/R	30.1	C
Old Wolf Road	NB L/T/R	16.2	B
Old Wolf Road	SB L/T/R	24.1	C
OVERALL		**25.5**	**C**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	53.0	D
Watervliet Shaker Road	WB LT	24.0	C
Exit 5 SB Off-Ramp	SB L	35.2	D
	SB T/R	24.9	C
Sherwood Drive	SB L/T/R	48.8	D
OVERALL		**36.6**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	30.0	C
	EB T/R	11.0	B
Watervliet Shaker Road	WB L	14.6	B
	WB TT/R	20.2	C
Holly Lane	NB L/T/R	33.9	C
Exit 5 NB Off-Ramp	SB L	32.1	C
	SB T/R	10.5	B
OVERALL		**21.7**	**C**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-7
VISSIM Analysis Results
Intersection Level of Service
2036 (ETC+20) No-Build AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	43.9	D
	EB TT	21.4	C
Central Avenue	WB TTT	39.1	D
	WB R	9.3	A
Exit 2 NB Off-Ramp	NB TTT	42.0	D
Wolf Road	SB LL	46.9	D
	SB RR	7.3	A
OVERALL		**30.4**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	34.4	C
	EB T	30.5	C
	EB R	2.7	A
Sand Creek Road	WB L	35.4	D
	WB T	32.8	C
	WB R	5.9	A
Wolf Road	NB L	46.4	D
	NB TT	15.2	B
	NB R	8.0	A
Wolf Road	SB L	45.6	D
	SB TT	22.0	C
	SB R	10.0	B
OVERALL		**22.5**	**C**
Metro Park & Wolf Road			
Hess Station	EB L/T/R	30.2	C
Metro Park Drive	WB L	44.9	D
	WB T/R	9.1	A
Wolf Road	NB L	3.1	A
	NB TT	2.1	A
	NB R	4.1	A
Wolf Road	SB L	3.2	A
	SB TT/R	2.6	A
OVERALL		**3.7**	**A**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	59.9	E
	EB R	17.2	B
Wolf Road	NB TTT	13.2	B
	SB TT	9.3	A
OVERALL		**22.6**	**C**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	39.8	D
	EB TT/R	22.9	C
	EB R	12.0	B
Albany Shaker Road	WB L	24.3	C
	WB TT	21.3	C
	WB R	3.4	A
Wolf Road	NB L	49.8	D
	NB L/TT	38.2	D
	NB R	8.6	A
OVERALL		**24.4**	**C**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	49.7	D
	EB TT	42.3	D
	EB R	28.2	C
Albany Shaker Road	WB L	28.0	C
	WB TT/R	42.0	D
Old Wolf Road	SB LL/T	83.9	F
	SB R	72.1	E
OVERALL		**53.7**	**D**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	9.4	A
CD Road	WB L/T/R	69.3	E
Old Wolf Road	NB L/T/R	44.8	D
Old Wolf Road	SB L/T/R	328.7	F
OVERALL		**115.2**	**F**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	17.6	B
Watervliet Shaker Road	WB LT	18.3	B
Exit 5 SB Off-Ramp	SB L	26.3	C
	SB T/R	17.1	B
Sherwood Drive	SB L/T/R	26.5	C
OVERALL		**19.6**	**B**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	24.2	C
	EB T/R	10.0	A
Watervliet Shaker Road	WB L	13.0	B
	WB TT/R	15.1	B
Holly Lane	NB L/T/R	38.7	D
Exit 5 NB Off-Ramp	SB L	25.4	C
	SB T/R	12.1	B
OVERALL		**15.8**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-8
VISSIM Analysis Results
Intersection Level of Service
2036 (ETC+20) No-Build PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	58.0	E
	EB TT	21.0	C
Central Avenue	WB TTT	42.7	D
	WB R	25.3	C
Exit 2 NB Off-Ramp	NB TTT	56.5	E
Wolf Road	SB LL	64.8	E
	SB RR	30.5	C
OVERALL		**39.3**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	142.4	F
	EB T	124.3	F
	EB R	74.7	E
Sand Creek Road	WB L	190.3	F
	WB T	203.3	F
	WB R	120.4	F
Wolf Road	NB L	70.9	E
	NB TT	39.4	D
	NB R	18.5	B
Wolf Road	SB L	66.7	E
	SB TT	37.9	D
	SB R	21.1	C
OVERALL		**78.6**	**E**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	45.4	D
Metro Park Drive	WB L	54.0	D
	WB T/R	39.0	D
Wolf Road	NB L	54.2	D
	NB TT	43.8	D
	NB R	32.4	C
Wolf Road	SB L	12.1	B
	SB TT/R	4.5	A
OVERALL		**29.5**	**C**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	99.3	F
	EB R	10.1	B
Wolf Road	NB TTT	198.5	F
	SB TT	5.7	A
OVERALL		**115.2**	**F**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	111.8	F
	EB TT/R	29.2	C
	EB R	11.1	B
Albany Shaker Road	WB L	28.2	C
	WB T T	38.6	D
	WB R	34.8	C
Wolf Road	NB L	55.3	E
	NB L/TT	70.8	E
	NB R	12.0	B
OVERALL		**44.8**	**D**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	518.3	F
	EB TT	459.7	F
	EB R	447.0	F
Albany Shaker Road	WB L	88.7	F
	WB TT/R	33.8	C
Old Wolf Road	SB LL/T	72.3	E
	SB R	48.0	D
OVERALL		**212.1**	**F**
Old Wolf Road & CD Road			
Site Driveway	EB L/T/R	6.3	A
CD Road	WB L/T/R	37.5	D
Old Wolf Road	NB L/T/R	15.9	B
Old Wolf Road	SB L/T/R	28.7	C
OVERALL		**30.7**	**C**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	63.3	E
Watervliet Shaker Road	WB LT	25.9	C
Exit 5 SB Off-Ramp	SB L	36.1	D
	SB T/R	28.0	C
Sherwood Drive	SB L/T/R	56.0	E
OVERALL		**41.5**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	30.4	C
	EB T/R	10.8	B
Watervliet Shaker Road	WB L	18.9	B
	WB TT/R	21.5	C
Holly Lane	NB L/T/R	39.5	D
Exit 5 NB Off-Ramp	SB L	32.5	C
	SB T/R	10.9	B
OVERALL		**22.2**	**C**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-9
VISSIM Analysis Results
Intersection Level of Service
2046 (ETC+30) No-Build AM

Intersection/Approach		Delay *	LOS
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	104.5	F
	EB R	49.6	D
Wolf Road	NB TTT	18.5	B
	SB TT	9.1	A
OVERALL		**38.5**	**D**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	32.8	C
	EB TT/R	23.2	C
	EB R	12.7	B
Albany Shaker Road	WB L	28.8	C
	WB TT	23.4	C
	WB R	5.5	A
Wolf Road	NB L	51.2	D
	NB L/TT	44.5	D
	NB R	8.5	A
OVERALL		**25.5**	**C**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	64.3	E
	EB TT	53.3	D
	EB R	49.8	D
Albany Shaker Road	WB L	26.7	C
	WB TT/R	42.1	D
Old Wolf Road	SB LL/T	89.3	F
	SB R	76.5	E
OVERALL		**58.7**	**E**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.1.1-10
VISSIM Analysis Results
Intersection Level of Service
2046 (ETC+30) No-Build PM

Intersection/Approach		Delay *	LOS
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB LL	137.7	F
	EB R	25.9	C
Wolf Road	NB TTT	339.6	F
	SB TT	5.9	A
OVERALL		**169.6**	**F**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB L	95.4	F
	EB TT/R	36.3	D
	EB R	14.7	B
Albany Shaker Road	WB L	35.0	D
	WB T T	44.0	D
	WB R	29.3	C
Wolf Road	NB L	61.0	E
	NB L/TT	55.3	E
	NB R	10.2	B
OVERALL		**43.0**	**D**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	469.8	F
	EB TT	424.4	F
	EB R	500.6	F
Albany Shaker Road	WB L	96.1	F
	WB TT/R	41.8	D
Old Wolf Road	SB LL/T	95.5	F
	SB R	73.8	E
OVERALL		**214.6**	**F**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

10.1.2 Freeway Level of Service

Freeway analyses for I-87 were conducted in accordance with the Highway Capacity Manual (HCM2000) using HCS+. The analyses were conducted for the freeway segments between Exits 2 and 4, Exits 4 and 5, Exits 5 and 6, and on the segments on the bridge over Albany-Shaker Road. Ramp junctions were evaluated at Exits 2, 4 and 5. Weave areas were evaluated at Exit 2. All of these analyses were conducted for Existing, ETC, ETC+10 and ETC+20. The freeway segment over Albany-Shaker Road was also evaluated for ETC+30. The level of service worksheets for all of the freeway analyses are provided in Attachment E.

The results of the AM and PM peak hour Existing and No-Build freeway analyses are summarized in Exhibits 2.3.1.7 c, 2.3.1.7 d, F.10.1.2-1 and F.10.1.2-2.

Exhibit 2.3.1.7 c
Freeway Level of Service
2009 Existing
AM Peak Hour

Direction	Segment/Junction	Existing (2009)	
		Density pc/mi/ln	LOS
FREEWAY SEGMENTS			
NB	Exit 2W on to Exit 4 off	19.6	C
	Exit 4 off to Exit 4 on	14.4	B
	Exit 4 on to Exit 5 off	17.6	B
	Exit 5 on to Exit 6 off	12.3	B
SB	Exit 6 on to Exit 5 off	29.9	D
	Exit 4 off to Exit 5 on	28.8	D
	Exit 5 on to Exit 4 on	30.1	D
	Exit 4 on to Exit 2W off	33.8	D
RAMP JUNCTIONS			
NB	Exit 2W on-ramp	16.5	B
	Exit 4 off-ramp	22.2	C
	Exit 4 on-ramp	15.6	B
	Exit 5 off-ramp	21.2	C
SB	Exit 4 off-ramp	33.3	D
	Exit 5 on-ramp	26.5	C
	Exit 4 on-ramp	27.9	C
	Exit 2W off-ramp	33.0	D
WEAVE AREAS			
NB	Exit 2E on-ramp to Exit 2W off-ramp	22.0	C
SB	Exit 2W on-ramp to Exit 2E off-ramp	28.5	D

pc/mi/ln = passenger cars per mile per lane

Exhibit 2.3.1.7 d Freeway Level of Service 2009 Existing PM Peak Hour			
Direction	**Segment/Junction**	**Existing (2009)**	
		Density pc/mi/ln[1]	**LOS**
FREEWAY SEGMENTS			
NB	Exit 2W on to Exit 4 off	36.3	E
	Exit 4 off to Exit 4 on	31.5	D
	Exit 4 on to Exit 5 off	**	F
	Exit 5 on to Exit 6 off	31.5	D
SB	Exit 6 on to Exit 5 off	16.2	B
	Exit 4 off to Exit 5 on	16.3	B
	Exit 5 on to Exit 4 on	17.6	B
	Exit 4 on to Exit 2W off	24.5	C
RAMP JUNCTIONS			
NB	Exit 2W on-ramp	29.4	D
	Exit 4 off-ramp	33.4	D
	Exit 4 on-ramp	35.8	F
	Exit 5 off-ramp	45.0	F
SB	Exit 4 off-ramp	20.1	C
	Exit 5 on-ramp	16.9	B
	Exit 4 on-ramp	22.1	C
	Exit 2W off-ramp	25.5	C
WEAVE AREAS			
NB	Exit 2E on-ramp to Exit 2W off-ramp	39.2	E
SB	Exit 2W on-ramp to Exit 2E off-ramp	29.4	D

1 - pc/mi/ln = passenger cars per mile per lane
** - Density is greater than 45 pc/mi/ln and can no longer be calculated with the basic freeway analysis. Segment is oversaturated.

Exhibit F.10.1-1 Freeway Level of Service No-Build AM Peak Hour									
Direction	Segment/Junction	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
		Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS
FREEWAY SEGMENTS									
NB	Exit 2W on to Exit 4 off	19.6	C	19.6	C	19.6	C	-	-
	Exit 4 off to Exit 4 on	14.7	B	14.7	B	14.4	B	13.7	B
	Exit 4 on to Exit 5 off	18.0	B	18.0	B	18.3	C	-	-
	Exit 5 on to Exit 6 off	12.3	B	12.5	B	12.8	B	-	-
SB	Exit 6 on to Exit 5 off	29.9	D	29.6	D	29.6	D	-	-
	Exit 4 off to Exit 5 on	28.8	D	29.1	D	29.7	D	-	-
	Exit 5 on to Exit 4 on	30.4	D	31.0	D	31.4	D	31.4	D
	Exit 4 on to Exit 2W off	34.2	D	34.6	D	35.0	D	-	-
RAMP JUNCTIONS									
NB	Exit 2W on-ramp	16.6	B	16.7	B	16.6	B	-	-
	Exit 4 off-ramp	22.0	C	22.0	C	22.1	C	-	-
	Exit 4 on-ramp	16.8	B	16.7	B	16.3	B	-	-
	Exit 5 off-ramp	22.0	C	21.9	C	22.2	C	-	-
SB	Exit 4 off-ramp	32.8	D	32.8	D	32.8	D	-	-
	Exit 5 on-ramp	25.5	C	25.8	C	26.5	C	-	-
	Exit 4 on-ramp	28.1	D	28.5	D	28.6	D	-	-
	Exit 2W off-ramp	33.0	D	33.2	D	33.4	D	-	-
WEAVE AREAS									
NB	Exit 2E on-ramp to Exit 2W off-ramp	21.4	C	21.6	C	21.6	C	-	-
SB	Exit 2W on-ramp to Exit 2E off-ramp	31.1	D	32.0	D	32.8	D	-	-

pc/mi/ln = passenger cars per mile per lane

Exhibit F.10.1-2 Freeway Level of Service No-Build PM Peak Hour									
Direction	Segment/Junction	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
		Density pc/mi/ln[1]	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS
FREEWAY SEGMENTS									
NB	Exit 2W on to Exit 4 off	36.3	E	36.8	E	37.3	E	-	-
	Exit 4 off to Exit 4 on	31.5	D	31.5	D	32.2	D	31.8	D
	Exit 4 on to Exit 5 off	**	F	**	F	**	F	-	-
	Exit 5 on to Exit 6 off	32.0	D	32.3	D	32.8	D	-	-
SB	Exit 6 on to Exit 5 off	16.9	B	17.9	B	18.6	C	-	-
	Exit 4 off to Exit 5 on	16.7	B	17.0	B	18.0	B	-	-
	Exit 5 on to Exit 4 on	18.3	C	18.6	C	19.3	C	19.9	C
	Exit 4 on to Exit 2W off	25.2	C	25.8	C	26.8	D	-	-
RAMP JUNCTIONS									
NB	Exit 2W on-ramp	29.6	D	29.6	D	29.9	D	-	-
	Exit 4 off-ramp	33.5	D	33.7	D	33.9	D	-	-
	Exit 4 on-ramp	36.7	F	37.0	F	37.8	F	-	-
	Exit 5 off-ramp	46.6	F	47.3	F	48.1	F	-	-
SB	Exit 4 off-ramp	19.3	B	20.4	C	20.9	C	-	-
	Exit 5 on-ramp	16.7	B	17.1	B	18.0	B	-	-
	Exit 4 on-ramp	22.7	C	23.5	C	24.5	C	-	-
	Exit 2W off-ramp	26.2	C	26.8	C	27.7	C	-	-
WEAVE AREAS									
NB	Exit 2E on-ramp to Exit 2W off-ramp	39.1	E	38.8	E	38.9	E	-	-
SB	Exit 2W on-ramp to Exit 2E off-ramp	26.8	C	27.6	C	28.6	D	-	-

1 - pc/mi/ln = passenger cars per mile per lane
** - Density is greater than 45 pc/mi/ln and can no longer be calculated with the basic freeway analysis. Segment is oversaturated.

During the AM peak hour, all of the freeway segments, ramp junctions and weave areas are estimated to operate at LOS D or better through ETC+20. There are some locations where the analysis of future No-Build conditions shows a decrease in vehicle density from the Existing conditions. This is related to the projected regional changes in travel patterns and mode choice of CDTC's regional travel demand model, which indicate either no growth of mainline traffic combined with slight growth on the ramp or slight decreases in ramp volumes.

During the PM peak hour, the following locations operate at LOS E or worse under the Existing condition in the northbound direction:

- Freeway Segments
  - Exit 2W on to Exit 4 off
  - Exit 4 on to Exit 5 off
- Ramp Junctions
  - Exit 4 on-ramp
  - Exit 5 off-ramp
- Weave Areas
  - Exit 2E on to Exit 2W off

Through the ETC+20 design year, the same freeway facilities are estimated to continue to operate at LOS E or F. There is no substantial degradation in these operations beyond the Existing condition because there is little growth estimated in peak hour traffic on I-87. Similar to the AM peak hour, there are a few

instances where the density reported decreases in a future year; these instances are related to slight decreases in ramp volumes from the regional demand model.

10.2 Level of Service for Build Alternatives

Two build alternatives were evaluated for the purpose of this study: the Diamond Alternative and Flyover Alternative.

Summaries of the LOS for each build alternative for the ETC, ETC+10, ETC+20, and ETC+30 future year conditions are presented in the subsequent sections. Note that the ETC+30 condition was only evaluated for the intersections adjacent to the bridges.

10.2.1 Diamond Alternative

10.2.1.1 Intersection Level of Service

Summaries of the LOS for the future design years, for the Diamond Alternative, are presented in Exhibits F.10.2.1.1-1 through F.10.2.1.1-8. As shown in these analyses, there are intersections within the study area, but outside the project area, that continue to have movements that experience LOS E or worse at ETC+20 during the studied peak hours. These intersections are:

- Central Avenue & Wolf Road (PM)
- Sand Creek Road & Wolf Road (PM)
- Exit 5 SB Ramps & Watervliet-Shaker Road (PM)

At the project area intersections, all intersection approaches are estimated to operate at LOS D or better through ETC+20. There is one movement, the westbound left-turn at the Albany-Shaker Road & Connector Road intersection that operates at LOS E during both peak hours. This is relatively low volume movement and the LOS E is a result of signal timing priority given to the major through movements on Albany-Shaker Road and the Exit 4 ramps. Observation of other factors such as vehicle queue and volume-to-capacity ratio show that there is reserve capacity for the movement and the delay level is related to the cycle length used to serve the other major movements at the intersection.

The ETC+30 design year was also evaluated for the intersections adjacent to bridge structures that will be replaced as part of the project (I-87 over Albany-Shaker Road). All intersection approaches, at the intersections adjacent to the bridge structures, are estimated to operate at LOS D or better. The westbound left-turn at the Albany-Shaker Road & Connector Road intersection will continue to operate at LOS E during both beak hours.

Exhibit F.10.2.1.1-1
VISSIM Analysis Results
Intersection Level of Service
2016 (ETC) Diamond Alternative AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	40.4	D
	EB TT	19.9	B
Central Avenue	WB TTT	37.9	D
	WB R	7.6	A
Exit 2 NB Off-Ramp	NB TTT	40.2	D
Wolf Road	SB LL	43.7	D
	SB RR	6.1	A
OVERALL		**28.3**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	30.0	C
	EB T	26.2	C
	EB R	2.6	A
Sand Creek Road	WB L	31.6	C
	WB T	28.6	C
	WB R	4.9	A
Wolf Road	NB L	42.1	D
	NB TT	14.6	B
	NB R	8.3	A
Wolf Road	SB L	42.7	D
	SB TT	15.7	B
	SB R	9.0	A
OVERALL		**19.0**	**B**
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	23.7	C
	EB T	17.0	B
	EB R	6.9	A
Metro Park Drive	WB L	26.3	C
	WB T/R	29.4	C
Wolf Road	NB L	31.6	C
	NB TT	13.9	B
	NB R	6.8	A
Wolf Road	SB L	16.3	B
	SB TT	19.8	B
	SB R	6.9	A
OVERALL		**17.7**	**B**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	2.8	A
	EB R	4.1	A
Albany Shaker Road	WB L	10.1	B
	WB T T	4.9	A
Wolf Road	NB L	31.3	C
	NB R	8.7	A
OVERALL		**6.7**	**A**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	22.1	C
	EB TT	10.3	B
Albany Shaker Road	WB TT/R	15.6	B
Old Wolf Road	SB LL	28.4	C
	SB R	21.1	C
OVERALL		**18.3**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	25.8	C
Watervliet Shaker Road	WB LT	20.8	C
Exit 5 SB Off-Ramp	SB L	27.7	C
	SB T/R	22.4	C
Sherwood Drive	SB L/T/R	31.7	C
OVERALL		**23.7**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	27.0	C
	EB T/R	13.7	B
Watervliet Shaker Road	WB L	13.4	B
	WB TT/R	16.5	B
Holly Lane	NB L/T/R	38.3	D
Exit 5 NB Off-Ramp	SB L	26.6	C
	SB T/R	11.2	B
OVERALL		**17.6**	**B**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	8.2	A
	EB RR	3.7	A
Albany Shaker Road	WB L	42.8	D
	WB TT	5.2	A
Airport Connector	NB LL	34.9	C
	NB R	5.4	A
OVERALL		**13.9**	**B**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	19.6	B
	NB R	11.0	B
Airport Connector	WB T	16.8	B
Airport Connector	EB L	15.4	B
	EB T	4.7	A
OVERALL		**13.0**	**B**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	23.2	C
	SB R	4.9	A
Airport Connector	WB L	12.0	B
	WB T	6.8	A
Airport Connector	EB T	14.7	B
	EB R	1.4	A
OVERALL		**10.1**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-2
VISSIM Analysis Results
Intersection Level of Service
2016 (ETC) Diamond Alternative PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	54.2	D
	EB TT	19.2	B
Central Avenue	WB TTT	37.2	D
	WB R	19.7	B
Exit 2 NB Off-Ramp	NB TTT	52.6	D
Wolf Road	SB LL	62.0	E
	SB RR	26.0	C
OVERALL		**35.5**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	108.3	F
	EB T	92.0	F
	EB R	48.8	D
Sand Creek Road	WB L	161.0	F
	WB T	171.4	F
	WB R	92.5	F
Wolf Road	NB L	63.2	E
	NB TT	33.3	C
	NB R	12.3	B
Wolf Road	SB L	62.3	E
	SB TT	35.8	D
	SB R	18.4	B
OVERALL		**70.0**	**E**
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	30.0	C
	EB T	30.5	C
	EB R	18.2	B
Metro Park Drive	WB L	20.7	C
	WB T/R	35.8	D
Wolf Road	NB L	40.8	D
	NB TT	20.8	C
	NB R	7.8	A
Wolf Road	SB L	24.0	C
	SB TT	27.6	C
	SB R	12.0	B
OVERALL		**24.8**	**C**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	17.0	B
	EB R	5.9	A
Albany Shaker Road	WB L	18.6	B
	WB T T	7.7	A
Wolf Road	NB L	28.1	C
	NB R	8.7	A
OVERALL		**13.1**	**B**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	30.9	C
	EB TT	11.6	B
Albany Shaker Road	WB TT/R	15.4	B
Old Wolf Road	SB LL	29.5	C
	SB R	24.4	C
OVERALL		**19.4**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	51.8	D
Watervliet Shaker Road	WB LT	27.0	C
Exit 5 SB Off-Ramp	SB L	37.6	D
	SB T/R	8.6	A
Sherwood Drive	SB L/T/R	48.5	D
OVERALL		**38.2**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	26.7	C
	EB T/R	13.1	B
Watervliet Shaker Road	WB L	18.5	B
	WB TT/R	20.5	C
Holly Lane	NB L/T/R	35.3	D
Exit 5 NB Off-Ramp	SB L	28.9	C
	SB T/R	11.7	B
OVERALL		**20.6**	**C**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	23.5	C
	EB RR	7.5	A
Albany Shaker Road	WB L	40.9	D
	WB TT	8.5	A
Airport Connector	NB LL	31.4	C
	NB R	8.0	A
OVERALL		**19.1**	**B**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	18.9	B
	NB R	6.8	A
Airport Connector	WB T	41.3	D
Airport Connector	EB L	14.9	B
	EB T	15.1	B
OVERALL		**20.1**	**C**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	20.5	C
	SB R	11.6	B
Airport Connector	WB L	10.4	B
	WB T	25.7	C
Airport Connector	EB T	33.2	C
	EB R	7.1	A
OVERALL		**17.2**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-3
VISSIM Analysis Results
Intersection Level of Service
2026 (ETC+10) Diamond Alternative AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	39.3	D
	EB TT	20.0	B
Central Avenue	WB TTT	37.2	D
	WB R	8.2	A
Exit 2 NB Off-Ramp	NB TTT	39.6	D
Wolf Road	SB LL	45.1	D
	SB RR	6.8	A
OVERALL		**28.2**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	32.3	C
	EB T	28.1	C
	EB R	2.5	A
Sand Creek Road	WB L	33.5	C
	WB T	29.9	C
	WB R	5.0	A
Wolf Road	NB L	42.5	D
	NB TT	15.1	B
	NB R	9.0	A
Wolf Road	SB L	45.7	D
	SB TT	17.0	B
	SB R	9.3	A
OVERALL		**20.2**	**C**
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	25.6	C
	EB T	18.2	B
	EB R	6.8	A
Metro Park Drive	WB L	21.4	C
	WB T/R	28.5	C
Wolf Road	NB L	32.0	C
	NB TT	15.0	B
	NB R	7.0	A
Wolf Road	SB L	16.1	B
	SB TT	21.8	C
	SB R	6.8	A
OVERALL		**18.7**	**B**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	3.2	A
	EB R	4.3	A
Albany Shaker Road	WB L	11.4	B
	WB T T	4.9	A
Wolf Road	NB L	29.8	C
	NB R	8.7	A
OVERALL		**6.9**	**A**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	23.5	C
	EB TT	11.0	B
Albany Shaker Road	WB TT/R	15.9	B
Old Wolf Road	SB LL	28.9	C
	SB R	21.1	C
OVERALL		**18.9**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	34.8	C
Watervliet Shaker Road	WB LT	23.9	C
Exit 5 SB Off-Ramp	SB L	30.8	C
	SB T/R	26.9	C
Sherwood Drive	SB L/T/R	35.1	D
OVERALL		**27.8**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	30.4	C
	EB T/R	14.3	B
Watervliet Shaker Road	WB L	16.1	B
	WB TT/R	16.2	B
Holly Lane	NB L/T/R	39.3	D
Exit 5 NB Off-Ramp	SB L	27.2	C
	SB T/R	12.2	B
OVERALL		**18.2**	**B**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	9.2	A
	EB RR	3.7	A
Albany Shaker Road	WB L	42.4	D
	WB TT	5.5	A
Airport Connector	NB LL	32.9	C
	NB R	5.7	A
OVERALL		**14.4**	**B**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	19.3	B
	NB R	10.8	B
Airport Connector	WB T	22.9	C
Airport Connector	EB L	15.9	B
	EB T	12.0	B
OVERALL		**15.5**	**B**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	19.2	B
	SB R	5.2	A
Airport Connector	WB L	12.0	B
	WB T	14.7	B
Airport Connector	EB T	19.4	B
	EB R	1.5	A
OVERALL		**12.2**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-4
VISSIM Analysis Results
Intersection Level of Service
2026 (ETC+10) Diamond Alternative PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	56.4	E
	EB TT	20.0	C
Central Avenue	WB TTT	39.6	D
	WB R	21.2	C
Exit 2 NB Off-Ramp	NB TTT	53.5	D
Wolf Road	SB LL	62.4	E
	SB RR	27.7	C
OVERALL		**37.0**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	116.6	F
	EB T	108.4	F
	EB R	61.5	E
Sand Creek Road	WB L	169.2	F
	WB T	180.5	F
	WB R	99.9	F
Wolf Road	NB L	66.9	E
	NB TT	35.2	D
	NB R	14.4	B
Wolf Road	SB L	64.4	E
	SB TT	38.3	D
	SB R	20.6	C
OVERALL		**74.9**	**E**
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	32.1	C
	EB T	31.4	C
	EB R	19.3	B
Metro Park Drive	WB L	22.0	C
	WB T/R	36.5	D
Wolf Road	NB L	43.7	D
	NB TT	23.8	C
	NB R	8.7	A
Wolf Road	SB L	16.5	B
	SB TT	30.0	C
	SB R	13.9	B
OVERALL		**27.0**	**C**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	18.1	B
	EB R	6.5	A
Albany Shaker Road	WB L	26.2	C
	WB T T	7.8	A
Wolf Road	NB L	26.4	C
	NB R	9.1	A
OVERALL		**14.4**	**B**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	34.0	C
	EB TT	15.3	B
Albany Shaker Road	WB TT/R	17.2	B
Old Wolf Road	SB LL	29.3	C
	SB R	23.8	C
OVERALL		**21.0**	**C**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	63.2	E
Watervliet Shaker Road	WB LT	26.2	C
Exit 5 SB Off-Ramp	SB L	39.1	D
	SB T/R	9.1	A
Sherwood Drive	SB L/T/R	46.0	D
OVERALL		**43.1**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	32.1	C
	EB T/R	10.1	B
Watervliet Shaker Road	WB L	19.3	B
	WB TT/R	21.0	C
Holly Lane	NB L/T/R	40.7	D
Exit 5 NB Off-Ramp	SB L	31.6	C
	SB T/R	9.1	A
OVERALL		**21.5**	**C**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	23.2	C
	EB RR	7.4	A
Albany Shaker Road	WB L	47.2	D
	WB TT	6.6	A
Airport Connector	NB LL	29.3	C
	NB R	6.0	A
OVERALL		**18.2**	**B**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	19.0	B
	NB R	7.1	A
Airport Connector	WB T	51.7	D
Airport Connector	EB L	17.2	B
	EB T	15.9	B
OVERALL		**22.8**	**C**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	21.4	C
	SB R	13.5	B
Airport Connector	WB L	11.0	B
	WB T	26.8	C
Airport Connector	EB T	33.0	C
	EB R	7.4	A
OVERALL		**18.1**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-5
VISSIM Analysis Results
Intersection Level of Service
2036 (ETC+20) Diamond Alternative AM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	42.8	D
	EB TT	20.6	C
Central Avenue	WB TTT	36.5	D
	WB R	8.8	A
Exit 2 NB Off-Ramp	NB TTT	41.5	D
Wolf Road	SB LL	46.7	D
	SB RR	7.0	A
OVERALL		**29.0**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	32.1	C
	EB T	26.9	C
	EB R	2.5	A
Sand Creek Road	WB L	33.2	C
	WB T	30.3	C
	WB R	5.2	A
Wolf Road	NB L	44.0	D
	NB TT	16.5	B
	NB R	7.4	A
Wolf Road	SB L	44.5	D
	SB TT	18.2	B
	SB R	9.6	A
OVERALL		**21.1**	**C**
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	25.5	C
	EB T	24.3	C
	EB R	6.9	A
Metro Park Drive	WB L	21.9	C
	WB T/R	26.6	C
Wolf Road	NB L	33.8	C
	NB TT	15.4	B
	NB R	7.7	A
Wolf Road	SB L	13.1	B
	SB TT	21.6	C
	SB R	6.9	A
OVERALL		**18.9**	**B**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	3.6	A
	EB R	4.4	A
Albany Shaker Road	WB L	12.9	B
	WB T T	5.4	A
Wolf Road	NB L	29.8	C
	NB R	8.7	A
OVERALL		**7.3**	**A**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	23.8	C
	EB TT	11.1	B
Albany Shaker Road	WB TT/R	16.9	B
Old Wolf Road	SB LL	28.6	C
	SB R	21.2	C
OVERALL		**19.2**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	43.2	D
Watervliet Shaker Road	WB LT	26.1	C
Exit 5 SB Off-Ramp	SB L	34.6	C
	SB T/R	32.8	C
Sherwood Drive	SB L/T/R	35.6	D
OVERALL		**31.8**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	30.9	C
	EB T/R	15.2	B
Watervliet Shaker Road	WB L	15.6	B
	WB TT/R	17.1	B
Holly Lane	NB L/T/R	36.3	D
Exit 5 NB Off-Ramp	SB L	28.3	C
	SB T/R	12.3	B
OVERALL		**18.9**	**B**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	10.6	B
	EB RR	3.7	A
Albany Shaker Road	WB L	61.0	E
	WB TT	6.5	A
Airport Connector	NB LL	31.4	C
	NB R	6.4	A
OVERALL		**15.3**	**B**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	21.0	C
	NB R	10.6	B
Airport Connector	WB T	25.4	C
Airport Connector	EB L	22.6	C
	EB T	18.2	B
OVERALL		**18.9**	**B**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	20.7	C
	SB R	5.9	A
Airport Connector	WB L	11.8	B
	WB T	21.7	C
Airport Connector	EB T	25.1	C
	EB R	1.4	A
OVERALL		**15.6**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-6
VISSIM Analysis Results
Intersection Level of Service
2036 (ETC+20) Diamond Alternative PM

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	56.9	E
	EB TT	20.3	C
Central Avenue	WB TTT	41.4	D
	WB R	25.7	C
Exit 2 NB Off-Ramp	NB TTT	54.9	D
Wolf Road	SB LL	60.3	E
	SB RR	27.4	C
OVERALL		**38.0**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	133.6	F
	EB T	122.6	F
	EB R	73.2	E
Sand Creek Road	WB L	177.5	F
	WB T	190.7	F
	WB R	109.0	F
Wolf Road	NB L	68.2	E
	NB TT	36.1	D
	NB R	15.8	B
Wolf Road	SB L	66.3	E
	SB TT	37.5	D
	SB R	21.0	C
OVERALL		**79.1**	**E**
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	36.2	D
	EB T	30.8	C
	EB R	19.9	B
Metro Park Drive	WB L	26.5	C
	WB T/R	41.5	D
Wolf Road	NB L	47.9	D
	NB TT	23.6	C
	NB R	9.2	A
Wolf Road	SB L	20.7	C
	SB TT	31.9	C
	SB R	14.9	B
OVERALL		**29.4**	**C**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	19.6	B
	EB R	8.2	A
Albany Shaker Road	WB L	23.9	C
	WB T T	7.0	A
Wolf Road	NB L	36.5	D
	NB R	11.9	B
OVERALL		**16.3**	**B**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	46.3	D
	EB TT	2.0	A
Albany Shaker Road	WB TT/R	10.2	B
Old Wolf Road	SB LL	38.9	D
	SB R	31.0	C
OVERALL		**18.2**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	69.4	E
Watervliet Shaker Road	WB LT	31.4	C
Exit 5 SB Off-Ramp	SB L	41.4	D
	SB T/R	11.0	B
Sherwood Drive	SB L/T/R	52.0	D
OVERALL		**47.7**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	31.6	C
	EB T/R	12.1	B
Watervliet Shaker Road	WB L	21.3	C
	WB TT/R	20.8	C
Holly Lane	NB L/T/R	39.3	D
Exit 5 NB Off-Ramp	SB L	33.3	C
	SB T/R	11.0	B
OVERALL		**22.0**	**C**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	28.6	C
	EB RR	7.8	A
Albany Shaker Road	WB L	59.0	E
	WB TT	25.0	C
Airport Connector	NB LL	34.8	C
	NB R	9.7	A
OVERALL		**24.6**	**C**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	22.5	C
	NB R	7.1	A
Airport Connector	WB T	39.0	D
Airport Connector	EB L	20.4	C
	EB T	14.5	B
OVERALL		**22.1**	**C**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	26.0	C
	SB R	17.0	B
Airport Connector	WB L	10.5	B
	WB T	24.6	C
Airport Connector	EB T	32.6	C
	EB R	8.0	A
OVERALL		**18.9**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-7
VISSIM Analysis Results
Intersection Level of Service
2046 (ETC+30) Diamond Alternative AM

Intersection/Approach		Delay *	LOS
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	24.9	C
	EB T	23.8	C
	EB R	6.8	A
Metro Park Drive	WB L	24.5	C
	WB T/R	25.9	C
Wolf Road	NB L	33.4	C
	NB TT	14.2	B
	NB R	6.7	A
Wolf Road	SB L	16.3	B
	SB TT	22.0	C
	SB R	6.8	A
OVERALL		**18.7**	**B**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	3.7	A
	EB R	4.8	A
Albany Shaker Road	WB L	13.1	B
	WB T T	5.3	A
Wolf Road	NB L	31.0	C
	NB R	9.5	A
OVERALL		**7.8**	**A**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	25.0	C
	EB TT	13.0	B
Albany Shaker Road	WB TT/R	17.4	B
Old Wolf Road	SB LL	29.3	C
	SB R	21.0	C
OVERALL		**20.1**	**C**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	10.9	B
	EB RR	3.9	A
Albany Shaker Road	WB L	38.5	D
	WB TT	6.8	A
Airport Connector	NB LL	32.5	C
	NB R	6.5	A
OVERALL		**15.6**	**B**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	20.7	C
	NB R	11.2	B
Airport Connector	WB T	26.3	C
Airport Connector	EB L	19.3	B
	EB T	17.6	B
OVERALL		**18.4**	**B**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	20.6	C
	SB R	6.0	A
Airport Connector	WB L	10.6	B
	WB T	21.7	C
Airport Connector	EB T	25.6	C
	EB R	1.5	A
OVERALL		**15.7**	**B**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.1.1-8
VISSIM Analysis Results
Intersection Level of Service
2046 (ETC+30) Diamond Alternative PM

Intersection/Approach		Delay *	LOS
Metro Park Drive/Airport Connector & Wolf Road			
Airport Connector	EB L	36.5	D
	EB T	30.9	C
	EB R	20.0	C
Metro Park Drive	WB L	26.6	C
	WB T/R	42.5	D
Wolf Road	NB L	46.3	D
	NB TT	24.6	C
	NB R	9.5	A
Wolf Road	SB L	22.7	C
	SB TT	32.0	C
	SB R	15.9	B
OVERALL		**29.6**	**C**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB TT/R	19.4	B
	EB R	8.6	A
Albany Shaker Road	WB L	23.3	C
	WB T T	7.4	A
Wolf Road	NB L	35.0	D
	NB R	12.2	B
OVERALL		**16.2**	**B**

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	48.1	D
	EB TT	1.9	A
Albany Shaker Road	WB TT/R	10.7	B
Old Wolf Road	SB LL	38.8	D
	SB R	29.6	C
OVERALL		**18.4**	**B**
Airport Connector & Albany Shaker Road			
Albany Shaker Road	EB TT	29.7	C
	EB RR	8.6	A
Albany Shaker Road	WB L	59.4	E
	WB TT	24.6	C
Airport Connector	NB LL	34.8	C
	NB R	7.0	A
OVERALL		**24.8**	**C**
Diamond NB Ramps & Airport Connector			
Diamond NB Off-Ramp	NB L	22.8	C
	NB R	7.5	A
Airport Connector	WB T	42.4	D
Airport Connector	EB L	23.5	C
	EB T	14.7	B
OVERALL		**23.1**	**C**
Diamond SB Ramps & Airport Connector			
Diamond SB Off-Ramp	SB L	28.3	C
	SB R	18.3	B
Airport Connector	WB L	11.5	B
	WB T	25.2	C
Airport Connector	EB T	33.1	C
	EB R	9.6	A
OVERALL		**20.1**	**C**

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

10.2.1.2 Freeway Level of Service

Freeway analyses for I-87 were conducted in accordance with the Highway Capacity Manual (HCM2000) using HCS+. The analyses were conducted for the freeway segments between Exits 2 and 4, Exits 4 and 5, Exits 5 and 6, and on the segment under the proposed Connector Road and Diamond interchange. Ramp junctions were evaluated at Exits 2, 4 and 5. Weave areas were evaluated at Exit 2. All of these analyses were conducted for Existing, ETC, ETC+10 and ETC+20. The freeway segment under the proposed Connector Road and Diamond interchange was also evaluated for ETC+30.

The results of the AM and PM peak hour Flyover Alternative freeway analyses are summarized in Exhibits F.10.2.1.2-1 and F.10.2.1.2-2.

Exhibit F.10.2.1.2-1
Freeway Level of Service
Diamond Alternative
AM Peak Hour

Direction	Segment/Junction	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
		Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS
FREEWAY SEGMENTS									
NB	Exit 2W on to Exit 4 off	21.6	C	22.9	C	23.9	C	-	-
	Exit 4 off to Exit 4 on	16.0	B	16.7	B	16.7	B	17.0	B
	Exit 4 on to Exit 5 off	16.3	B	17.0	B	17.3	B	17.3	B
	Exit 5 on to Exit 6 off	11.8	B	12.5	B	12.5	B	-	-
SB	Exit 6 on to Exit 5 off	29.9	D	30.4	D	30.9	D	-	-
	Exit 5 on to Exit 4 off	35.4	E	37.7	E	40.4	E	40.4	E
	Exit 4 off to Exit 4 on	30.7	D	32.0	D	33.4	D	33.1	D
	Exit 4 on to Exit 2W off	34.2	D	34.6	D	35.0	D	-	-
RAMP JUNCTIONS									
NB	Exit 2W on-ramp	18.1	B	19.2	B	20.1	C	-	-
	Exit 4 off-ramp	20.9	C	22.2	C	23.3	C	-	-
	Exit 4 on-ramp	14.7	B	15.3	B	15.5	B	-	-
	Exit 5 off-ramp	19.2	B	19.8	B	20.1	C	-	-
SB	Exit 5 on-ramp	26.1	C	27.6	C	29.2	D	-	-
	Exit 4 off-ramp	29.8	D	31.0	D	32.1	D	-	-
	Exit 4 on-ramp	26.1	C	27.2	C	28.2	D	-	-
	Exit 2W off-ramp	33.3	D	33.6	D	33.8	D	-	-
WEAVE AREAS									
NB	Exit 2E on-ramp to Exit 2W off-ramp	22.2	C	23.6	C	24.8	C	-	-
SB	Exit 2W on-ramp to Exit 2E off-ramp	29.8	D	30.3	D	31.0	D	-	-

Exhibit F.10.2.1.2-2 Freeway Level of Service Diamond Alternative PM Peak Hour									
Direction	Segment/Junction	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
		Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS
FREEWAY SEGMENTS									
NB	Exit 2W on to Exit 4 off	39.5	E	40.2	E	40.8	E	-	-
	Exit 4 off to Exit 4 on	31.1	D	31.1	D	31.5	D	31.5	D
	Exit 4 on to Exit 5 off	43.0	E	43.7	E	44.6	E	**	F
	Exit 5 on to Exit 6 off	30.1	D	30.9	D	31.7	D	-	-
SB	Exit 6 on to Exit 5 off	17.2	B	17.8	B	18.4	C	-	-
	Exit 5 on to Exit 4 off	23.9	C	24.8	C	25.5	C	25.5	C
	Exit 4 off to Exit 4 on	17.6	B	18.0	B	18.3	C	18.0	B
	Exit 4 on to Exit 2W off	25.2	C	25.8	C	26.5	D	-	-
RAMP JUNCTIONS									
NB	Exit 2W on-ramp	31.1	D	31.2	D	31.4	D	-	-
	Exit 4 off-ramp	32.4	D	32.7	D	32.9	D	-	-
	Exit 4 on-ramp	29.7	D	30.1	D	30.8	D	-	-
	Exit 5 off-ramp	36.4	E	36.6	E	36.9	E	-	-
SB	Exit 5 on-ramp	18.4	B	19.6	B	20.1	C	-	-
	Exit 4 off-ramp	22.6	C	23.5	C	24.2	C	-	-
	Exit 4 on-ramp	21.8	C	22.3	C	22.8	C	-	-
	Exit 2W off-ramp	26.3	C	26.8	C	27.3	C	-	-
WEAVE AREAS									
NB	Exit 2E on-ramp to Exit 2W off-ramp	39.4	E	40.1	E	41.2	E	-	-
SB	Exit 2W on-ramp to Exit 2E off-ramp	23.9	C	24.9	C	25.8	C	-	-

During the AM peak hour, the following locations operate at LOS E under the ETC+20 condition in the southbound direction:

- Freeway Segments
  - Exit 5 on to Exit 4 off

During the PM peak hour, the following locations operate at LOS E under the ETC+20 condition in the northbound direction:

- Freeway Segments
  - Exit 2W on TO Exit 4 off
  - Exit 4 on to Exit 5 off
- Ramp Junctions
  - Exit 5 off
- Weave Areas
  - Exit 2E on to Exit 2W off

The southbound freeway segment between Exit 5 on and Exit 4 off is estimated to degrade from LOS D to LOS E during the AM peak hour when compared to No-Build ETC+20. The operations were approaching the LOS E threshold under the No-Build conditions and higher volume for the Diamond Alternative pushed it over the LOS E threshold (>35 pc/m/l). The new ramp configuration and removal of the C-D Road is the primary reason for the increase in traffic volume between Exits 5 and 4.

10.2.2 Flyover Alternative

10.2.2.1 Intersection Level of Service

Summaries of the LOS for the future design years for the Flyover Alternative are presented in Exhibits F.10.2.2.1-1 through F.10.2.2.1-8. As shown in these analyses, there are intersections within the study area, but outside the project area, that continue to have movements that experience LOS E or worse at ETC+20 during the studied peak hours:

- Central Avenue & Wolf Road (PM)
- Sand Creek Road & Wolf Road (PM)
- Exit 5 SB Ramps & Watervliet-Shaker Road (PM)

At the project area intersections, all intersection approaches are estimated to operate at LOS D or better through ETC+20. There is one movement, the westbound left-turn at the Albany-Shaker Road & New Exit 4 Ramps intersection, which operates at LOS E during both peak hours. This is a relatively low volume movement and the LOS E is a result of signal timing priority given to the major through movements on Albany-Shaker Road and the Exit 4 ramps. Observation of other factors such as vehicle queue and volume-to-capacity ratio show that there is reserve capacity for the movement and the delay level is related to the cycle length used to serve the other major movements at the intersection.

The ETC+30 design year was also evaluated for the intersections adjacent to bridge structures that will be replaced as part of the project (I-87 over Albany-Shaker Road). This evaluation was completed to confirm that additional geometry resulting in wider bridge width is not needed to support the ETC+30 design year.

Exhibit F.10.2.2.1-1
VISSIM Analysis Results
Intersection Level of Service
2016 (ETC) Flyover Alternative AM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Central Avenue & Wolf Road			
Central Avenue	EB LL	42.1	D
	EB TT	19.7	B
Central Avenue	WB TTT	38.4	D
	WB R	8.5	A
Exit 2 NB Off-Ramp	NB TTT	42.5	D
Wolf Road	SB LL	47.8	D
	SB RR	5.4	A
OVERALL		**29.2**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	29.9	C
	EB T	25.6	C
	EB R	2.3	A
Sand Creek Road	WB L	35.2	D
	WB T	31.8	C
	WB R	5.2	A
Wolf Road	NB L	39.5	D
	NB TT	14.2	B
	NB R	5.7	A
Wolf Road	SB L	43.1	D
	SB TT	16.4	B
	SB R	6.3	A
OVERALL		**19.0**	**B**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	36.7	D
Metro Park Drive	WB L	45.6	D
	WB T/R	8.7	A
Wolf Road	NB L	4.4	A
	NB TT	2.5	A
	NB R	4.1	A
Wolf Road	SB L	3.3	A
	SB TT/R	1.5	A
OVERALL		**3.5**	**A**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	51.1	D
	EB TT/R	7.0	A
	EB R	5.9	A
Albany Shaker Road	WB L	20.0	B
	WB T T	10.8	B
	WB R	5.0	A
Wolf Road	NB L	28.0	C
	NB L/TT	26.7	C
	NB R	2.1	A
OVERALL		**12.9**	**B**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	18.2	B
	EB TT	15.6	B
Albany Shaker Road	WB TT/R	13.5	B
Old Wolf Road	SB LL	29.4	C
	SB R	21.7	C
OVERALL		**18.0**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	17.1	B
Watervliet Shaker Road	WB LT	24.5	C
Exit 5 SB Off-Ramp	SB L	22.7	C
	SB T/R	24.3	C
Sherwood Drive	SB L/T/R	26.4	C
OVERALL		**23.1**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	20.0	C
	EB T/R	10.0	A
Watervliet Shaker Road	WB L	9.9	A
	WB TT/R	10.6	B
Holly Lane	NB L/T/R	28.2	C
Exit 5 NB Off-Ramp	SB L	21.4	C
	SB T/R	9.3	A
OVERALL		**12.3**	**B**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	18.6	B
	EB R	6.0	A
Albany Shaker Road	WB L	41.4	D
	WB TT	6.6	A
New Exit 4 Ramps	NB LL	22.7	C
	NB R	11.0	B
OVERALL		**15.2**	**B**

Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	14.8	B

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-2
VISSIM Analysis Results
Intersection Level of Service
2016 (ETC) Flyover Alternative PM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Central Avenue & Wolf Road			
Central Avenue	EB LL	58.0	E
	EB TT	19.8	B
Central Avenue	WB TTT	54.4	D
	WB R	29.2	C
Exit 2 NB Off-Ramp	NB TTT	54.8	D
Wolf Road	SB LL	62.8	E
	SB RR	30.1	C
OVERALL		**43.4**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	128.3	F
	EB T	107.7	F
	EB R	61.3	E
Sand Creek Road	WB L	154.1	F
	WB T	169.3	F
	WB R	86.0	F
Wolf Road	NB L	67.3	E
	NB TT	34.4	C
	NB R	14.3	B
Wolf Road	SB L	66.2	E
	SB TT	38.0	D
	SB R	22.2	C
OVERALL		**71.1**	**E**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	36.3	D
Metro Park Drive	WB L	45.1	D
	WB T/R	22.0	C
Wolf Road	NB L	7.3	A
	NB TT	6.4	A
	NB R	5.5	A
Wolf Road	SB L	8.1	A
	SB TT/R	4.0	A
OVERALL		**8.4**	**A**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	51.3	D
	EB TT/R	10.0	B
	EB R	5.5	A
Albany Shaker Road	WB L	25.0	C
	WB T T	19.5	B
	WB R	15.4	B
Wolf Road	NB L	23.4	C
	NB L/TT	26.5	C
	NB R	3.6	A
OVERALL		**19.5**	**B**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	20.8	C
	EB TT	17.7	B
Albany Shaker Road	WB TT/R	9.2	A
Old Wolf Road	SB LL	31.7	C
	SB R	17.8	B
OVERALL		**18.9**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	42.6	D
Watervliet Shaker Road	WB LT	23.9	C
Exit 5 SB Off-Ramp	SB L	36.2	D
	SB T/R	6.2	A
Sherwood Drive	SB L/T/R	45.6	D
OVERALL		**33.0**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	31.4	C
	EB T/R	12.5	B
Watervliet Shaker Road	WB L	18.9	B
	WB TT/R	21.0	C
Holly Lane	NB L/T/R	32.2	C
Exit 5 NB Off-Ramp	SB L	34.1	C
	SB T/R	10.2	B
OVERALL		**23.2**	**C**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	26.8	C
	EB R	9.5	A
Albany Shaker Road	WB L	64.3	E
	WB TT	10.9	B
New Exit 4 Ramps	NB LL	22.8	C
	NB R	8.9	A
OVERALL		**18.5**	**B**

Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	5.7	A

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-3
VISSIM Analysis Results
Intersection Level of Service
2026 (ETC+10) Flyover Alternative AM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Central Avenue & Wolf Road			
Central Avenue	EB LL	44.6	D
	EB TT	21.1	C
Central Avenue	WB TTT	40.2	D
	WB R	9.2	A
Exit 2 NB Off-Ramp	NB TTT	43.7	D
Wolf Road	SB LL	50.0	D
	SB RR	6.5	A
OVERALL		**31.2**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	33.7	C
	EB T	27.9	C
	EB R	2.5	A
Sand Creek Road	WB L	35.6	D
	WB T	32.5	C
	WB R	5.5	A
Wolf Road	NB L	43.4	D
	NB TT	14.5	B
	NB R	7.0	A
Wolf Road	SB L	44.8	D
	SB TT	18.3	B
	SB R	7.0	A
OVERALL		**20.3**	**C**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	37.8	D
Metro Park Drive	WB L	51.4	D
	WB T/R	8.6	A
Wolf Road	NB L	3.0	A
	NB TT	2.3	A
	NB R	4.2	A
Wolf Road	SB L	3.1	A
	SB TT/R	1.6	A
OVERALL		**3.5**	**A**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	48.4	D
	EB TT/R	6.9	A
	EB R	7.0	A
Albany Shaker Road	WB L	22.6	C
	WB T T	12.2	B
	WB R	5.2	A
Wolf Road	NB L	27.9	C
	NB L/TT	27.2	C
	NB R	2.3	A
OVERALL		**13.2**	**B**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	18.3	B
	EB TT	15.5	B
Albany Shaker Road	WB TT/R	13.7	B
Old Wolf Road	SB LL	28.6	C
	SB R	21.9	C
OVERALL		**17.8**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	17.7	B
Watervliet Shaker Road	WB LT	21.6	C
Exit 5 SB Off-Ramp	SB L	24.6	C
	SB T/R	18.3	B
Sherwood Drive	SB L/T/R	28.2	C
OVERALL		**21.1**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	23.2	C
	EB T/R	10.4	B
Watervliet Shaker Road	WB L	11.7	B
	WB TT/R	12.8	B
Holly Lane	NB L/T/R	32.1	C
Exit 5 NB Off-Ramp	SB L	24.1	C
	SB T/R	10.1	B
OVERALL		**14.2**	**B**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	23.1	C
	EB R	11.8	B
Albany Shaker Road	WB L	50.0	D
	WB TT	7.4	A
New Exit 4 Ramps	NB LL	20.6	C
	NB R	11.8	B
OVERALL		**17.0**	**B**

Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	20.3	C

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-4
VISSIM Analysis Results
Intersection Level of Service
2026 (ETC+10) Flyover Alternative PM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Central Avenue & Wolf Road			
Central Avenue	EB LL	57.7	E
	EB TT	19.8	B
Central Avenue	WB TTT	56.4	E
	WB R	31.5	C
Exit 2 NB Off-Ramp	NB TTT	55.3	E
Wolf Road	SB LL	65.1	E
	SB RR	33.1	C
OVERALL		**44.7**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	137.4	F
	EB T	121.1	F
	EB R	72.0	E
Sand Creek Road	WB L	170.5	F
	WB T	186.6	F
	WB R	102.9	F
Wolf Road	NB L	66.7	E
	NB TT	36.3	D
	NB R	14.6	B
Wolf Road	SB L	73.9	E
	SB TT	42.4	D
	SB R	28.6	C
OVERALL		**77.1**	**E**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	38.7	D
Metro Park Drive	WB L	46.0	D
	WB T/R	23.4	C
Wolf Road	NB L	10.8	B
	NB TT	7.5	A
	NB R	5.7	A
Wolf Road	SB L	8.3	A
	SB TT/R	4.1	A
OVERALL		**9.2**	**A**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	61.8	E
	EB TT/R	10.1	B
	EB R	5.5	A
Albany Shaker Road	WB L	27.1	C
	WB T T	21.8	C
	WB R	20.0	B
Wolf Road	NB L	24.4	C
	NB L/TT	29.8	C
	NB R	3.6	A
OVERALL		**22.2**	**C**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	22.4	C
	EB TT	17.6	B
Albany Shaker Road	WB TT/R	10.8	B
Old Wolf Road	SB LL	35.5	D
	SB R	19.9	B
OVERALL		**20.1**	**C**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	50.5	D
Watervliet Shaker Road	WB LT	27.3	C
Exit 5 SB Off-Ramp	SB L	38.1	D
	SB T/R	7.2	A
Sherwood Drive	SB L/T/R	44.4	D
OVERALL		**37.8**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	33.7	C
	EB T/R	13.9	B
Watervliet Shaker Road	WB L	18.2	B
	WB TT/R	23.1	C
Holly Lane	NB L/T/R	50.8	D
Exit 5 NB Off-Ramp	SB L	35.7	D
	SB T/R	12.4	B
OVERALL		**25.0**	**C**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	30.8	C
	EB R	10.1	B
Albany Shaker Road	WB L	68.3	E
	WB TT	9.9	A
New Exit 4 Ramps	NB LL	23.8	C
	NB R	9.7	A
OVERALL		**19.7**	**B**

Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	6.0	A

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-5
VISSIM Analysis Results
Intersection Level of Service
2036 (ETC+20) Flyover Alternative AM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Central Avenue & Wolf Road			
Central Avenue	EB LL	46.4	D
	EB TT	23.1	C
Central Avenue	WB TTT	41.7	D
	WB R	9.2	A
Exit 2 NB Off-Ramp	NB TTT	46.2	D
Wolf Road	SB LL	53.3	D
	SB RR	7.5	A
OVERALL		**33.6**	**C**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	34.9	C
	EB T	29.6	C
	EB R	2.8	A
Sand Creek Road	WB L	35.2	D
	WB T	34.0	C
	WB R	5.5	A
Wolf Road	NB L	45.2	D
	NB TT	16.6	B
	NB R	6.6	A
Wolf Road	SB L	47.0	D
	SB TT	19.7	B
	SB R	7.4	A
OVERALL		**21.8**	**C**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	40.9	D
Metro Park Drive	WB L	48.7	D
	WB T/R	9.0	A
Wolf Road	NB L	4.7	A
	NB TT	2.7	A
	NB R	4.5	A
Wolf Road	SB L	4.0	A
	SB TT/R	1.7	A
OVERALL		**3.7**	**A**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	33.7	C
	EB TT/R	9.0	A
	EB R	7.1	A
Albany Shaker Road	WB L	23.8	C
	WB T T	11.4	B
	WB R	5.2	A
Wolf Road	NB L	32.3	C
	NB L/TT	30.7	C
	NB R	2.4	A
OVERALL		**13.5**	**B**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	16.8	B
	EB TT	7.4	A
Albany Shaker Road	WB TT/R	12.8	B
Old Wolf Road	SB LL	31.6	C
	SB R	24.5	C
OVERALL		**14.1**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	22.6	C
Watervliet Shaker Road	WB LT	21.7	C
Exit 5 SB Off-Ramp	SB L	28.3	C
	SB T/R	17.2	B
Sherwood Drive	SB L/T/R	26.5	C
OVERALL		**22.5**	**C**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	26.1	C
	EB T/R	10.4	B
Watervliet Shaker Road	WB L	10.9	B
	WB TT/R	15.8	B
Holly Lane	NB L/T/R	32.8	C
Exit 5 NB Off-Ramp	SB L	27.8	C
	SB T/R	11.5	B
OVERALL		**16.7**	**B**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	27.3	C
	EB R	11.9	B
Albany Shaker Road	WB L	61.9	E
	WB TT	11.3	B
New Exit 4 Ramps	NB LL	21.7	C
	NB R	15.8	B
OVERALL		**20.0**	**C**

Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	28.2	D

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-6
VISSIM Analysis Results
Intersection Level of Service
2036 (ETC+20) Flyover Alternative PM

Signalized Intersections

Intersection/Approach		Delay *	LOS
Central Avenue & Wolf Road			
Central Avenue	EB LL	59.0	E
	EB TT	21.3	C
Central Avenue	WB TTT	58.9	E
	WB R	33.3	C
Exit 2 NB Off-Ramp	NB TTT	58.3	E
Wolf Road	SB LL	67.5	E
	SB RR	36.3	D
OVERALL		**46.9**	**D**
Sand Creek Road & Wolf Road			
Sand Creek Road	EB L	142.2	F
	EB T	130.9	F
	EB R	81.3	F
Sand Creek Road	WB L	189.1	F
	WB T	206.9	F
	WB R	118.5	F
Wolf Road	NB L	70.0	E
	NB TT	37.8	D
	NB R	15.9	B
Wolf Road	SB L	81.2	F
	SB TT	50.5	D
	SB R	37.1	D
OVERALL		**83.1**	**F**
Metro Park Drive & Wolf Road			
Hess Station	EB L/T/R	37.1	D
Metro Park Drive	WB L	45.1	D
	WB T/R	19.8	B
Wolf Road	NB L	9.2	A
	NB TT	7.5	A
	NB R	5.8	A
Wolf Road	SB L	10.0	A
	SB TT/R	4.0	A
OVERALL		**9.1**	**A**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	52.0	D
	EB TT/R	12.1	B
	EB R	6.1	A
Albany Shaker Road	WB L	25.6	C
	WB T T	20.7	C
	WB R	17.6	B
Wolf Road	NB L	33.9	C
	NB L/TT	46.0	D
	NB R	3.7	A
OVERALL		**24.2**	**C**

Signalized Intersections

Intersection/Approach		Delay *	LOS
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	23.6	C
	EB TT	9.1	A
Albany Shaker Road	WB TT/R	8.4	A
Old Wolf Road	SB LL	52.6	D
	SB R	26.6	C
OVERALL		**19.1**	**B**
Exit 5 SB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L/TT/R	64.2	E
Watervliet Shaker Road	WB LT	29.3	C
Exit 5 SB Off-Ramp	SB L	40.2	D
	SB T/R	8.7	A
Sherwood Drive	SB L/T/R	49.1	D
OVERALL		**43.6**	**D**
Exit 5 NB Ramps & Watervliet Shaker Road			
Watervliet Shaker Road	EB L	34.7	C
	EB T/R	12.2	B
Watervliet Shaker Road	WB L	18.3	B
	WB TT/R	23.6	C
Holly Lane	NB L/T/R	45.4	D
Exit 5 NB Off-Ramp	SB L	36.0	D
	SB T/R	14.2	B
OVERALL		**25.0**	**C**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	36.4	D
	EB R	10.6	B
Albany Shaker Road	WB L	73.1	E
	WB TT	13.5	B
New Exit 4 Ramps	NB LL	27.0	C
	NB R	14.0	B
OVERALL		**22.7**	**C**

Unsignalized Intersections

Intersection/Approach		Delay *	LOS
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	6.0	A

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-7
VISSIM Analysis Results
Intersection Level of Service
2046 (ETC+30) Flyover Alternative AM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	49.2	D
	EB TT/R	9.2	A
	EB R	8.3	A
Albany Shaker Road	WB L	24.9	C
	WB T T	11.8	B
	WB R	5.5	A
Wolf Road	NB L	31.4	C
	NB L/TT	30.0	C
	NB R	2.6	A
OVERALL		**14.5**	**B**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	20.2	C
	EB TT	14.9	B
Albany Shaker Road	WB TT/R	14.1	B
Old Wolf Road	SB LL	32.1	C
	SB R	24.1	C
OVERALL		**18.3**	**B**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	28.0	C
	EB R	7.4	A
Albany Shaker Road	WB L	78.4	E
	WB TT	9.7	A
New Exit 4 Ramps	NB LL	21.3	C
	NB R	16.5	B
OVERALL		**20.2**	**C**
Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	81.9	F

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

Exhibit F.10.2.2.1-8
VISSIM Analysis Results
Intersection Level of Service
2046 (ETC+30) Flyover Alternative PM

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Albany Shaker Road & Wolf Road			
Albany Shaker Road	EB LL	82.5	F
	EB TT/R	12.6	B
	EB R	6.8	A
Albany Shaker Road	WB L	31.8	C
	WB T T	26.0	C
	WB R	32.6	C
Wolf Road	NB L	30.4	C
	NB L/TT	53.1	D
	NB R	3.3	A
OVERALL		**31.0**	**C**
Albany Shaker Road & Old Wolf Road			
Albany Shaker Road	EB L	24.8	C
	EB TT	12.0	B
Albany Shaker Road	WB TT/R	7.4	A
Old Wolf Road	SB LL	48.5	D
	SB R	26.5	C
OVERALL		**19.2**	**B**

Signalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
New Exit 4 Ramps & Albany Shaker Road			
Albany Shaker Road	EB TT	39.5	D
	EB R	11.3	B
Albany Shaker Road	WB L	78.2	E
	WB TT	12.5	B
New Exit 4 Ramps	NB LL	32.0	C
	NB R	24.6	C
OVERALL		**26.5**	**C**

Unsignalized Intersections			
Intersection/Approach		**Delay ***	**LOS**
Exit 4 NB Off-Ramp & Wolf Road			
Exit 4 NB Off-Ramp	EB R	7.4	A

** Delay provided in seconds per vehicle.*

L=Left, T=Through, R=Right, L/T=shared Left/Through, T/R=shared Through/Right

10.2.2.2 Freeway Level of Service

Freeway analyses for I-87 were conducted in accordance with the Highway Capacity Manual (HCM2000) using HCS+. The analyses were conducted for the freeway segments between Exits 2 and 4, Exits 4 and 5, Exits 5 and 6, on the segments on the bridge over Albany-Shaker Road and on the segments under the proposed Flyover ramps. Ramp junctions were evaluated at Exits 2, 4 and 5. Weave areas were evaluated at Exit 2. All of these analyses were conducted for Existing, ETC, ETC+10 and ETC+20. The freeway segments over Albany-Shaker Road under the Flyover ramp were also evaluated for ETC+30.

The results of the AM and PM peak hour Flyover Alternative freeway analyses are summarized in Exhibits F.10.2.2.2-1 and F.10.2.2.2-2.

Exhibit F.10.2.2.2-1
Freeway Level of Service
Flyover Alternative
AM Peak Hour

Direction	Segment/Junction	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
		Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS
FREEWAY SEGMENTS									
NB	Exit 2W on to Exit 4 off	21.2	C	21.9	C	22.9	C	-	-
	Exit 4 off to Exit 4 off	16.0	B	15.7	B	16.0	B	16.0	B
	Exit 4 off to Exit 4 on	14.4	B	14.4	B	14.7	B	14.4	B
	Exit 4 on to Exit 5 off	13.2	B	13.5	B	13.7	B	-	-
	Exit 5 on to Exit 6 off	12.5	B	12.8	B	13.0	B	-	-
SB	Exit 6 on to Exit 5 off	29.4	D	29.9	D	30.1	D	-	-
	Exit 5 on to Exit 4 off	35.0	D	37.7	E	40.4	E	40.4	E
	Exit 4 off to Exit 4 on	31.0	D	32.4	D	33.4	D	33.4	D
	Exit 4 on to Exit 2W off	35.4	E	35.8	E	36.2	E	-	-
RAMP JUNCTIONS									
NB	Exit 2W on-ramp	18.0	B	18.6	B	19.5	B	-	-
	Exit 4 off-ramp to ASR	20.3	C	21.1	C	22.3	C	-	-
	Exit 4 off-ramp to Wolf	17.5	B	17.2	B	17.5	B	-	-
SB	Exit 5 on-ramp	26.1	C	27.8	C	29.5	D	-	-
	Exit 4 off-ramp	26.3	C	27.7	C	28.9	D	-	-
	Exit 4 on-ramp	27.1	C	28.5	D	29.6	D	-	-
	Exit 2W off-ramp	33.6	D	33.8	D	34.1	D	-	-
WEAVE AREAS									
NB	Exit 2E on-ramp to Exit 2W off-ramp	21.8	C	22.7	C	23.9	C	-	-
SB	Exit 2W on-ramp to Exit 2E off-ramp	32.4	D	33.1	D	33.8	D	-	-

Exhibit F.10.2.2.2-2 Freeway Level of Service Flyover Alternative PM Peak Hour									
Direction	Segment/Junction	ETC (2016)		ETC+10 (2026)		ETC+20 (2036)		ETC+30 (2046)	
		Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS	Density pc/mi/ln	LOS
FREEWAY SEGMENTS									
NB	Exit 2W on to Exit 4 off	40.8	E	42.2	E	43.0	E	-	-
	Exit 4 off to Exit 4 off	30.8	D	31.1	D	30.8	D	29.7	D
	Exit 4 off to Exit 4 on	30.1	D	30.4	D	30.1	D	29.0	D
	Exit 4 on to Exit 5 off	30.9	D	31.2	D	31.2	D	-	-
	Exit 5 on to Exit 6 off	32.3	D	32.4	D	32.5	D	-	-
SB	Exit 6 on to Exit 5 off	17.2	B	17.9	B	18.6	C	-	-
	Exit 5 on to Exit 4 off	23.9	C	24.8	C	25.5	C	25.5	C
	Exit 4 off to Exit 4 on	19.3	C	19.9	C	19.9	C	19.6	C
	Exit 4 on to Exit 2W off	25.5	C	26.1	D	27.1	D	-	-
RAMP JUNCTIONS									
NB	Exit 2W on-ramp	31.9	D	32.3	D	32.4	D	-	-
	Exit 4 off-ramp to ASR	33.0	D	33.6	D	34.0	D	-	-
	Exit 4 off-ramp to Wolf	29.3	D	29.6	D	29.3	D	-	-
SB	Exit 5 on-ramp	18.5	B	19.3	B	20.1	C	-	-
	Exit 4 off-ramp	18.8	B	19.7	B	20.4	C	-	-
	Exit 4 on-ramp	20.7	C	21.4	C	21.6	C	-	-
	Exit 2W off-ramp	26.3	C	26.8	C	27.6	C	-	-
WEAVE AREAS									
NB	Exit 2E on-ramp to Exit 2W off-ramp	39.6	E	41.1	E	41.8	E	-	-
SB	Exit 2W on-ramp to Exit 2E off-ramp	26.7	C	26.5	C	29.2	D	-	-

During the AM peak hour, the following locations operate at LOS E under the ETC+20 condition in the southbound direction:

- Freeway Segments
  - Exit 5 on to Exit 4 off
  - Exit 4 on to Exit 2W off

During the PM peak hour, the following locations operate at LOS E under the ETC+20 condition in the northbound direction:

- Freeway Segments
  - Exit 2W on to Exit 4 off
- Weave Areas
  - Exit 2E on to Exit 2W off

The operations for some of these locations are a change from a LOS D in the No-Build condition. The southbound freeway segments from Exit 5 to Exit 4 and Exit 4 to Exit 2W were approaching the LOS E threshold under the No-Build conditions and slightly higher volume for the Flyover Alternative pushed them over the LOS E threshold (>35 pc/m/l). The new ramp configuration and removal of the C-D Road is the primary reason for the increase in traffic volume between Exits 5 and 4. The segment from Exit 4 to Exit 2W was exactly at the threshold for No-Build ETC+20 AM and adds only 150 additional vehicles for the Flyover Alternative.

10.3 Travel Time

Travel time on the network roadways was evaluated from the VISSIM models for the future No-Build and Build alternative conditions. The 2036 (ETC+20) travel time comparisons are presented in Exhibits 3.3.1.5 a and 3.3.1.5 b. These routes represent the major routes that measure whether the alternatives meets one of the key needs of the project: access improvements between I-87, Wolf Road and the Albany International Airport.

Exhibit 3.3.1.5 a
Travel Time Estimates
2036 (ETC+20) Build Alternatives
AM Peak Hour

Roadway: Segment	No-Build (m:ss)	Diamond (m:ss)	Flyover (m:ss)
Northbound			
I-87: Sand Creek Overpass to Airport	6:05	4:23	3:41
I-87: Sand Creek Overpass to Exit 6 Off-Ramp	3:55	3:55	3:56
Southbound			
I-87: Exit 6 On-Ramp to Airport	7:03	6:10	4:59
I-87: Exit 6 On-Ramp to Wolf Road (Metro Park)	6:53	4:33	5:19
I-87: Exit 6 On-Ramp to Sand Creek Overpass	3:37	3:40	3:35

m:ss = minutes:seconds

Exhibit 3.3.1.5 b
Travel Time Estimates
2036 (ETC+20) Build Alternatives
PM Peak Hour

Roadway: Segment	No-Build (m:ss)	Diamond (m:ss)	Flyover (m:ss)
Northbound			
I-87: Sand Creek Overpass to Airport	7:37	4:40	3:52
I-87: Sand Creek Overpass to Exit 6 Off-Ramp	4:36	4:38	4:33
Southbound			
I-87: Exit 6 On-Ramp to Airport	5:57	6:37	5:09
I-87: Exit 6 On-Ramp to Wolf Road (Metro Park)	6:05	4:49	5:23
I-87: Exit 6 On-Ramp to Sand Creek Overpass	3:46	3:43	3:41

m:ss = minutes:seconds

The Diamond Alternative reduces the expected travel time for major routes by 20% when compared to the No-Build Alternative. In the southbound direction during the AM peak hour, the travel time to the airport is reduced from 7:03 to 6:10 (0:53 reduction) and the travel time to Metro Park Road is reduced from 6:53 to 4:33 (2:20 reduction). In the northbound direction during the PM peak hour, the travel time to airport is reduced from 7:37 to 4:40 (2:57 reduction). However, the travel time to the airport in the southbound direction during the PM peak hour is estimated to be greater than the No-Build Alternative. This is a result of the longer distance a vehicle must travel to reach the Exit 4 southbound off-ramp and then to Albany-Shaker Road.

The Flyover Alternative reduces the expected travel time for major routes by 25% when compared to the No-Build Alternative. In the southbound direction during the AM peak hour, the travel time to the airport is reduced from 7:03 to 4:59 (2:07 reduction) and the travel time to Metro Park Road is reduced from 6:53 to 5:19 (1:34 reduction). In the northbound direction during the PM peak hour, the travel time to the airport is reduced from 7:37 to 3:52 (3:45 reduction).

For both alternatives, the northbound and southbound through travel times (between Sand Creek Road Overpass and Exit 6 ramps) on I-87 are approximately the same as No-Build. As a result, it is not anticipated that the Build Alternatives will increase delay for through vehicles on I-87.

Overall, the Flyover Alternative provides the most reductions in travel time when compared to the No-Build condition.

10.4 Network Delay and Distance Traveled

Network-wide measures of effectiveness (MOE's) were gathered from the VISSIM models to compare the Build alternatives. Vehicle hours of delay (VHD) and vehicle miles traveled (VMT) are both presented in Exhibit 3.3.1.7 y.

Exhibit 3.3.1.7 y
Network Measures of Effectiveness
2036 (ETC+20) Design Year

	No-Build	Diamond	Flyover
AM Peak Hour			
Vehicle Hours of Delay	274	219	195
Vehicle Miles Traveled	55,940	56,530	57,480
PM Peak Hour			
Vehicle Hours of Delay	785	402	372
Vehicle Miles Traveled	63,480	70,450	66,140

As shown, the Build alternatives dramatically reduce the VHD during the PM peak hour, with the Flyover Alternative providing slightly better VHD improvements than the Diamond Alternative. For the Diamond Alternative, the VHD decreases by 20% for the AM Peak Hour and 49% for the PM Peak Hour. For the Flyover Alternative, the VHD decreases by 29% for the AM Peak Hour, and 53% for the PM Peak Hour. The VMT increases for both of the Build alternatives compared to the No-Build condition because they both have greater volume demand than the No-Build condition (i.e. more volume is diverted to the improved interchange). So although the distance that some vehicles travel within the network is reduced due to the Build alternative geometry, the increased number of vehicles in turn causes increased VMT.

10.5 Ramp Queues

The ETC+20 design year 95th percentile queues for the I-87 off-ramps at Exits 4, 5, and 6 were determined using Synchro 7. Exhibit 3.3.1.7 z below provides a summary of the ETC+20 design year queues; the No-Build queues are provided for comparison purposes.

Exhibit 3.3.1.7 z 95th Percentile Queues - ETC+20 Design Year No-Build & Diamond Alternative					
Approach	**mvmt**	**No-Build AM**	**Diamond AM**	**No-Build PM**	**Diamond PM**
Exit 4 Ramps					
Exit 4 NB Off-Ramp	L	310*	159	380	266
	R	137	103	123	41
Exit 4 SB Off-Ramp	LR	878	-	551	-
	L	-	257	-	482
	R	-	154	-	471
Exit 5 Ramps					
Exit 5 NB Off-Ramp	L	157	161	418	408
	TR	59	22	0	0
Exit 5 SB Off-Ramp	L	395	767	410	740
	TR	223	494	336	249
Exit 6 Ramps					
Exit 6 NB Off-Ramp	L	350	336	237	190
	R	50	36	50	21
Exit 6 SB Off-Ramp	L	174	147	216	219
	R	494	540	661	593

* All 95th Percentile Queues shown in feet.

As shown, all of the Diamond Alternative queues are estimated to be approximately the same or less than the No-Build queues with the exception of the Exit 5 southbound off-ramp. The Exit 5 southbound left-turn movement for both peak periods and the through/right turn movement during the AM peak hour are estimated to have longer queues than the No-Build Alternative. The longer queues at this off-ramp are a result of the elimination of the C-D Road to Old Wolf Road, and the resulting redistribution of volumes in the area. However, it is estimated that the queues for these movements will not extend back to the I-87 mainline.

It is also noted that existing queue observations show that the Exit 4 SB off-ramp often backs to the I-87 mainline during the AM peak hour. The extent of that queue is not captured in the No-Build Synchro results shown since it is a cumulative result of the southbound queue on Old Wolf Road at Albany-Shaker Road backing to the intersection with the Exit 4 SB off-ramp. Since the C-D Road is eliminated with the Diamond Alternative, this queuing condition is also eliminated.

The ETC+20 design year 95th percentile queues for the I-87 off-ramps at Exits 4, 5, and 6 were determined using Synchro 7. Exhibit 3.3.1.7 aa below provides a summary of the ETC+20 design year queues; the No-Build queues are provided for comparison purposes.

Exhibit 3.3.1.7 aa 95th Percentile Queues - ETC+20 Design Year No-Build & Flyover Alternative					
Approach	**mvmt**	**No-Build AM**	**Flyover AM**	**No-Build PM**	**Flyover PM**
Exit 4 Ramps					
Exit 4 NB Off-Ramp to Wolf Rd	L	310*	-	380	-
	R	137	57	123	21
Exit 4 SB Off-Ramp to Old Wolf Rd	LR	878	-	551	-
Exit 4 Off-Ramp to ASR	L	-	367	-	728
	R	-	534	-	518
Exit 5 Ramps					
Exit 5 NB Off-Ramp	L	157	156	418	493
	TR	59	21	0	0
Exit 5 SB Off-Ramp	L	395	385	410	610
	TR	223	276	336	231
Exit 6 Ramps					
Exit 6 NB Off-Ramp	L	350	380	237	189
	R	50	53	50	14
Exit 6 SB Off-Ramp	L	174	201	216	229
	R	494	554	661	615

* All 95th Percentile Queues shown in feet.

For the Flyover Alternative, all of the Build Alternative queues are estimated to be approximately the same or less than the No-Build queues with the exception of the Exit 4 off-ramp to Albany-Shaker Road and the Exit 5 southbound left-turn movement during the PM peak hour. It is estimated that the Exit 4 off-ramp to Albany-Shaker Road queue will be longer than No-Build due to the combination of the northbound off-ramp left-turn volume and the southbound off-ramp volume at the new intersection. However, the queue is not estimated to extend back to the I-87 mainline. As with the Diamond Alternative, the Exit 5 SB off-ramp queue is estimated to be longer than the No-Build Alternative due to the elimination of the C-D road, and the resulting redistribution of volume. It is not estimated that the southbound queue will extend back to the I-87 mainline in this alternative.

Like the Diamond Alternative, since the C-D Road is eliminated with the Flyover Alternative, the existing queuing condition of the Exit 4 SB off-ramp to the I-87 mainline is eliminated.

11.0 Safety Considerations, Accident History and Analysis

NYSDOT Region 1 conducted an accident history investigation for the project study area. The accident data covered a three year period from January 1, 2007 to December 31, 2009 and covered the project study area on I-87, Wolf Road, Watervliet-Shaker Road, Albany-Shaker Road and Old Wolf Road. They provided an updated set of data that included an additional three months of data and included a signal study that was conducted at the intersection of Albany-Shaker Road & Old Wolf Road/I-87 SB on-ramp. The memos, accident records and collision diagrams are included in Attachment F.

The current High Accident Location (HAL) period is from November 1, 2007 to October 31, 2009. There were no HALs on the section of I-87 studied from RM 2016 (Colonie Town Line) to RM 2042 (just north of the Exit 5 northbound on ramp). Wolf Road (NY 910B) was a Priority Investigation Location (PIL) from RM 1010 (Computer Drive) to RM 1015 (just south of Marcus Boulevard) and from RM 1016 (Marcus Boulevard) to 1019 (Albany-Shaker Road). Watervliet-Shaker Road (NY 155) was a Safety Deficient Location (SDL) from RM 3058 (Sherwood Drive) to RM 3060 (Old Niskayuna Road).

I-87 is a six lane divided Urban Principal Arterial Interstate highway with full control of access. There were 303 total accidents on this segment of I-87 during the study period. The accident rate was 0.87 accidents per million vehicle miles (acc/mvm) which is less than the expected accident rate of 1.10 acc/mvm for similar highways statewide. There was one fatality and no accidents involving pedestrians or bicyclists.

Wolf Road is a four lane divided Urban Principal Arterial highway with free access. There were 52 accidents in the first section studied (RM 1010 to 1015) during the January 1, 2007 to March 31, 2010 study period. The accident rate was 2.41 acc/mvm which is less than the expected accident rate of 3.59 acc/mvm for similar highways statewide. There was one accident involving a pedestrian and no accidents involving bicyclists.

There were 132 accidents in the second section of Wolf Road studied (RM 1016 to 1019) and the accident rate was 9.46 acc/mvm which is greater than the expected accident rate of 3.59 acc/mvm for similar highways statewide. There were no accidents involving pedestrians or bicyclists.

Watervliet-Shaker Road is a four lane undivided Urban Minor Arterials highway with free access. There were 46 accidents on the SDL section (RM 3058 to 3061 (Feiden Lane)) evaluated during the period January 1, 2007 to September 30, 2010. The accident rate of 8.79 acc/mvm is greater than the expected accident rate of 4.27 acc/mvm for similar highways statewide. There were no accidents involving pedestrians or bicyclists.

Albany-Shaker Road (CR 151) carries NY Touring Route 155. There were 55 accidents on the section studied, and the accident rate was 1.98 acc/mvm. This rate cannot be compared to the statewide average as it is not a state route. There were no accidents involving pedestrians or bicyclists.

Old Wolf Road (CR 153) also carries NY Touring Route 155. There were 55 accidents on the section studied, and the accident rate was 5.11 acc/mvm. This rate cannot be compared to the statewide average as it is not a state route. There were no accidents involving pedestrians and one involving a bicyclist.

The majority of accidents on all the roadways reviewed in the study occurred during the peak hours and are congestion related.

A summary crash severity for the project area is provided in Exhibit 2.3.1.8 a and a summary of accident type for the project area intersections is provided in Exhibit 2.3.1.8 b.

Exhibit 2.3.1.8 a Crash Severity Jan 1, 2007 to Dec 31, 2009				
Facility Type	**Non-Reportable**	**Property Damage Only**	**Personal Injury**	**Fatality**
Non-freeway	0%	62%	38%	0%
Freeway	22%	53%	25%	0%*

* There was one fatality reported during the studied period.

Exhibit 2.3.1.8 b Crash Types: Intersections Jan 1, 2007 to Dec 31, 2009										
Link	**Head On**	**Right Angle**	**Rear End**	**Left Turn**	**Fixed Object**	**Over take**	**Side swipe**	**Ped/ Bike**	**Backing**	**Total**
Wolf Road & Metro Park Road	1	3	3	2	0	2	0	0	0	11
Wolf Road & I-87 Exit 4 NB off-ramp	0	0	9	0	0	3	0	0	0	12
Wolf Road & Albany-Shaker Road	0	10	42	27	0	6	0	0	0	85
Albany-Shaker Road & Old Wolf Road/I-87 Exit 4 SB on-ramp	0	1	11	5	1	1	2	0	0	21
Old Wolf Road & I-87 Exit 4 SB off-ramp	0	0	33	0	1	0	0	0	0	34
Watervliet-Shaker Road & I-87 Exit 5 NB ramps	0	1	2	4	2	0	0	0	0	9
Watervliet-Shaker Road & I-87 Exit 5 SB ramps	0	2	6	4	0	1	0	1	1	15
Total	1	17	106	42	4	13	2	1	1	187

The accident rates for intersections are expressed as accidents per million entering vehicles (ACC/MEV) and accident rates for roadway links are expressed as accidents per million vehicle miles (ACC/MVM). For intersections on or including State facilities, the statewide average accident rate for similar facilities is provided for comparison purposes. Accident rates for the project area intersections are summarized in Exhibit 2.3.1.8 c.

Exhibit 2.3.1.8 c Intersection Accident Rates		
Intersection	**Accident Rate ACC/MEV**	**Statewide Average ACC/MEV**
Wolf Road & Metro Park Road	0.27	0.15
Wolf Road & I-87 Exit 4 NB off-ramp	0.33	0.11
Wolf Road & Albany-Shaker Road	1.54	0.11
Albany-Shaker Road & Old Wolf Road/I-87 Exit 4 SB on-ramp	0.46	0.11
Old Wolf Road & I-87 Exit 4 SB off-ramp	1.77	0.19
Watervliet-Shaker Road & I-87 Exit 5 NB ramps	0.35	0.15
Watervliet-Shaker Road & I-87 Exit 5 SB ramps	0.66	0.15

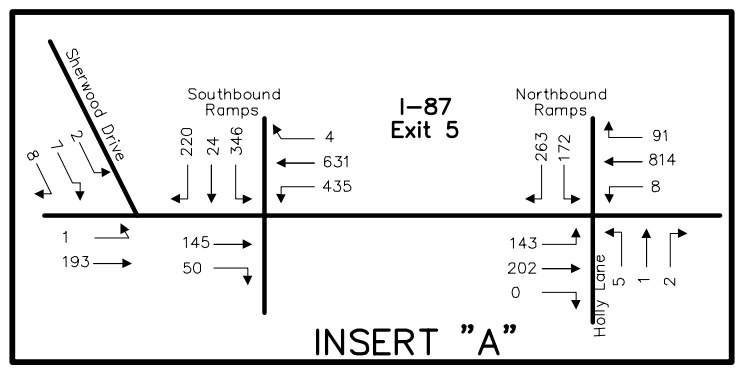
As summarized in Exhibit 2.3.1.8 c, all of the studied intersections exceed statewide averages for similar facilities. Locations that particularly stand out as greatly exceeding the statewide average are Wolf Road & Albany-Shaker Road and Old Wolf Road & I-87 Exit 4 SB off-ramp. The predominant accident types at Wolf Road & Albany-Shaker Road were rear end and left-turn. At Old Wolf Road & I-87 Exit 4 SB off-ramp, all but one of the reported accidents were rear ends. A high occurrence of rear end accidents typically correlates to traffic congestion where vehicles are in stop-and-go traffic and/or reaching the end of forming queues.

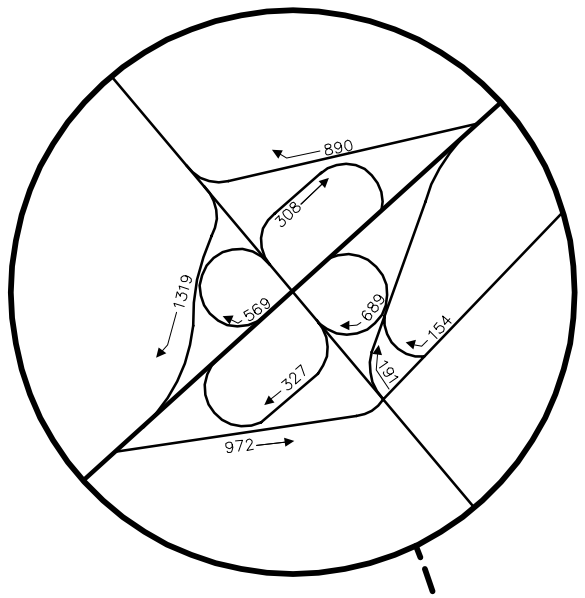
The dismissed Upgrade Alternative did not address many of the crash patterns in the study area since the alternative only included adding additional capacity at the existing intersections and is not estimated to divert traffic to other routes. The existing C-D road between Watervliet-Shaker Road and Old Wolf Road, which also serves the Exit 4 southbound off-ramp and Exit 5 southbound on-ramp, is maintained with the Upgrade Alternative. In addition to the 34 accidents at the intersection with Old Wolf Road & I-87 SB off-ramp, another 14 accidents occurred on the C-D road during the studied period. Traffic routinely backs up on the C-D road to the Exit 4 southbound off-ramp. While it would be anticipated that the number of accidents would be reduced due to less congestion under the alternative, the geometric conditions in this area would remain the same.

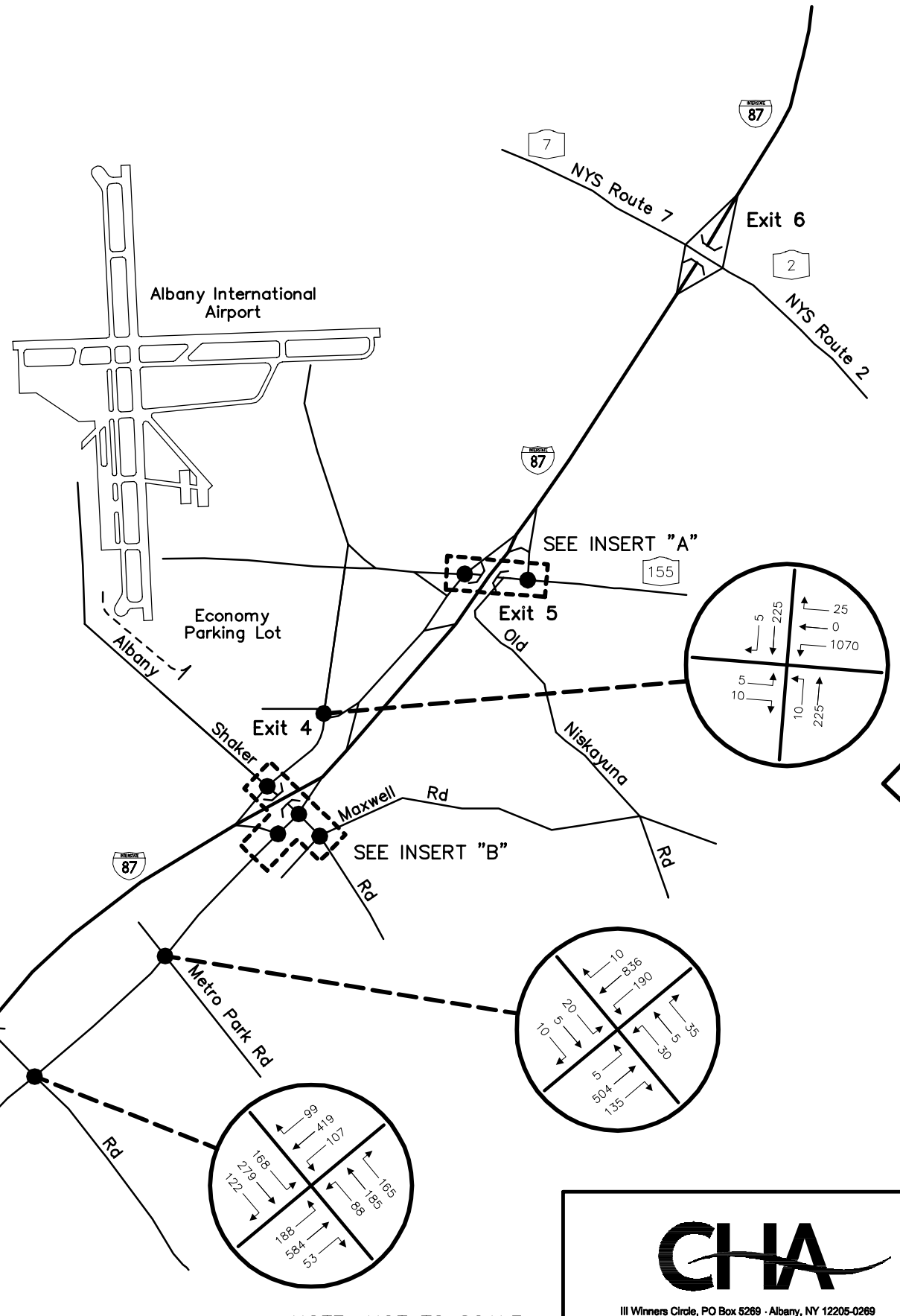
The Flyover and Diamond Alternatives both remove the C-D road and the existing Exit 4 and 5 ramp configuration, therefore eliminating those accidents and resulting in an accident cost savings of $584,000 per year ($11,680,000 over 20 years). The traffic volumes at the Wolf Road & Albany-Shaker Road intersection are also reduced under these alternatives which will improve operations and safety. The Diamond Alternative removes the Exit 4 northbound on-ramp and reduces the peak hour volumes at this intersection by 42 percent. The Flyover Alternative reduces the peak hour volumes at this intersection by 35 percent.

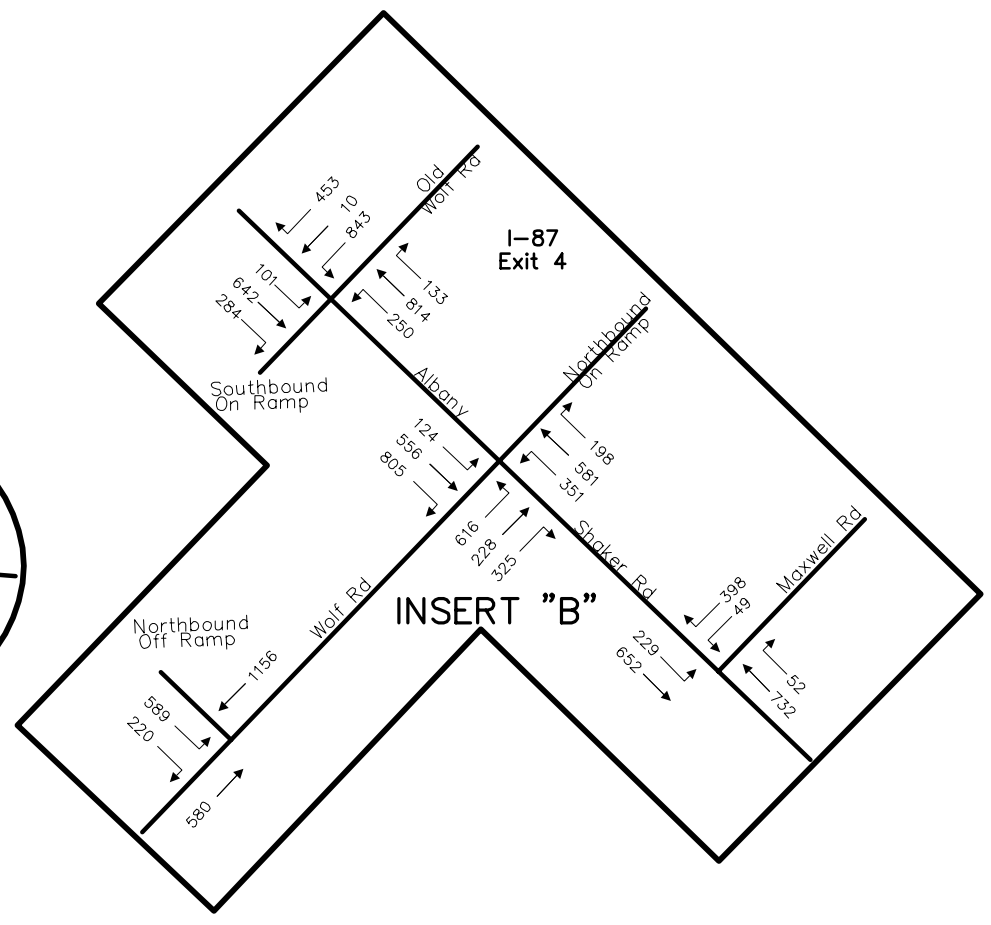
The Flyover and Diamond Alternatives will also improve safety at the intersections with Albany-Shaker Road & Old Wolf Road/I-87 Exit 4 southbound on-ramp and Wolf Road & I-87 Exit 4 northbound off-ramp. The Flyover Alternative eliminates the I-87 Exit 4 southbound on-ramp at the existing intersection and modifies the I-87 Exit 4 northbound off-ramp to be unsignalized with right-turns onto Wolf Road southbound only. The Diamond Alternative eliminates the I-87 Exit 4 southbound on-ramp and the I-87 Exit 4 northbound off-ramp at their existing intersections. These modifications reduce volume and congestion.

ATTACHMENT A
FIGURES









GRID NORTH

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2009 EXISTING AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F-1

DATE: 8/13

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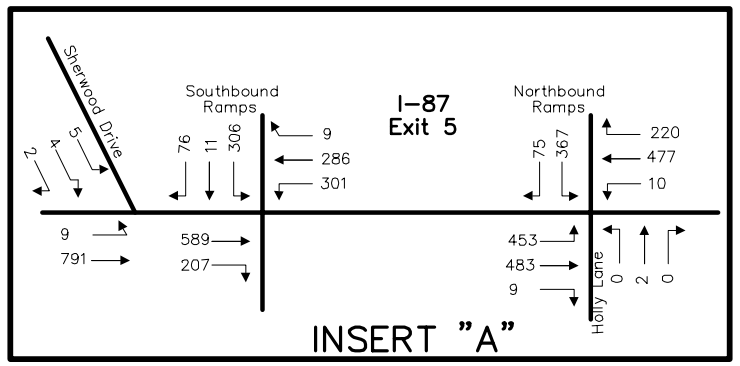
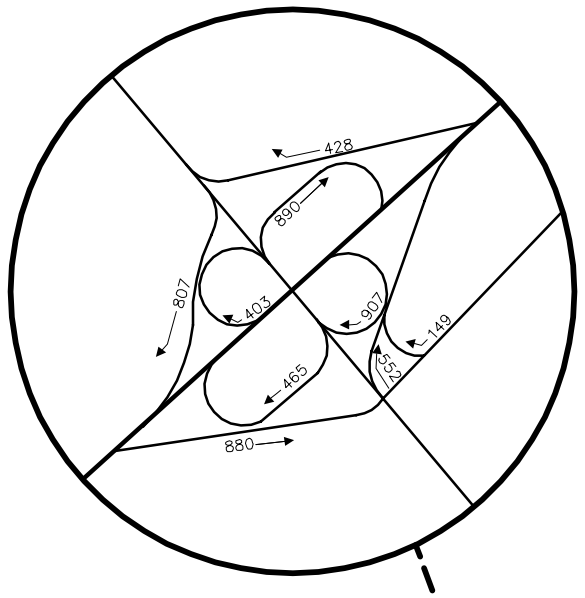
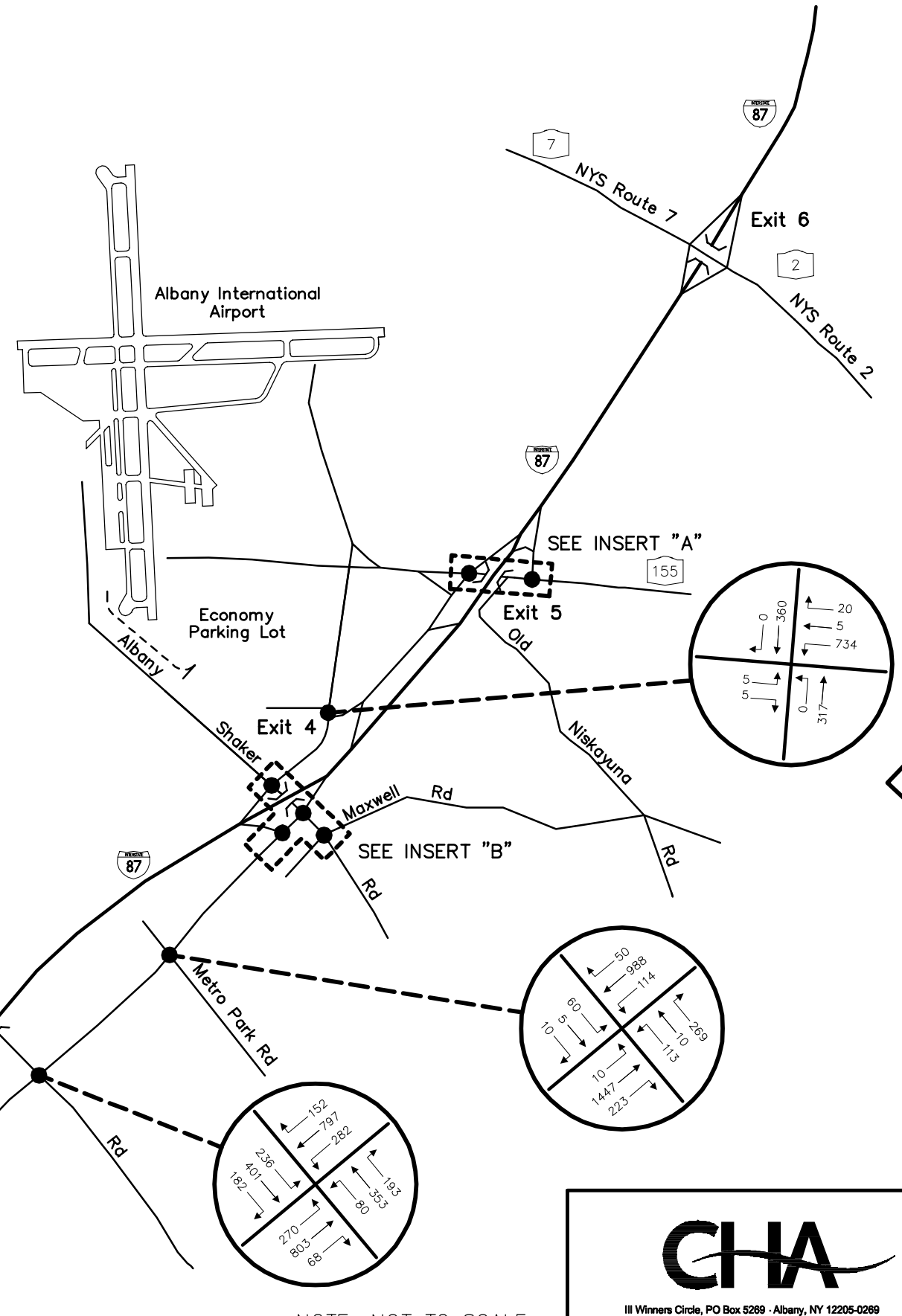
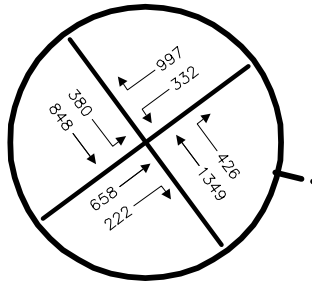
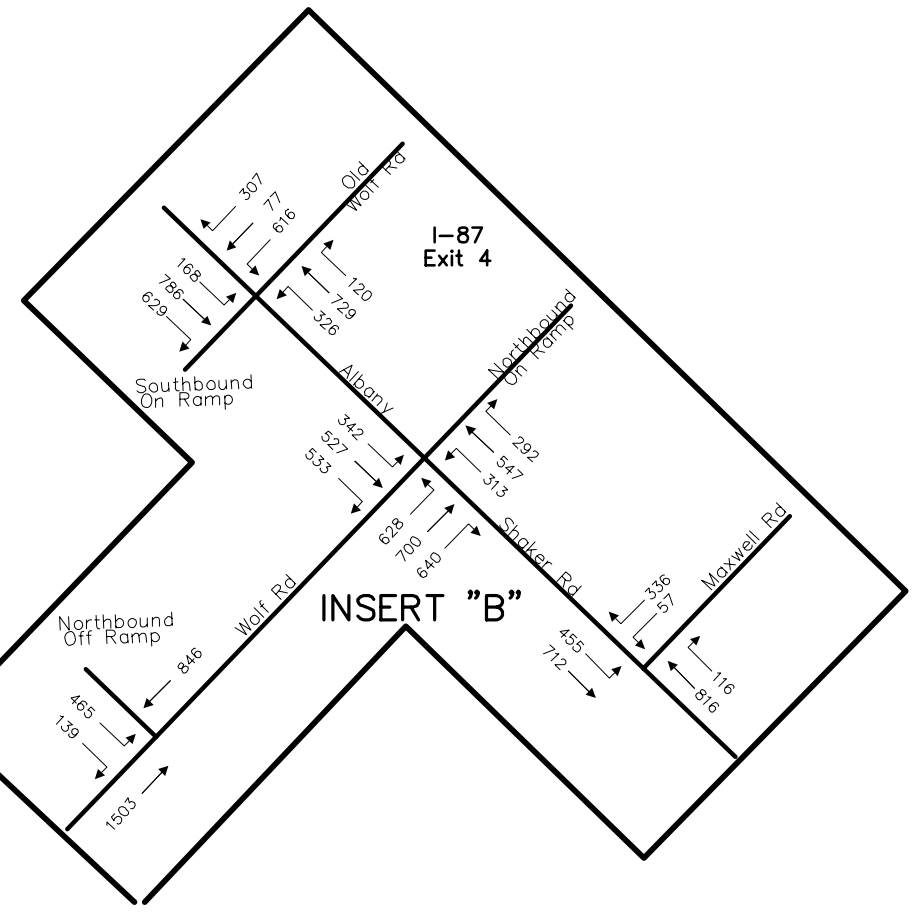
GRID NORTH











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2009 EXISTING PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

FIGURE F–2

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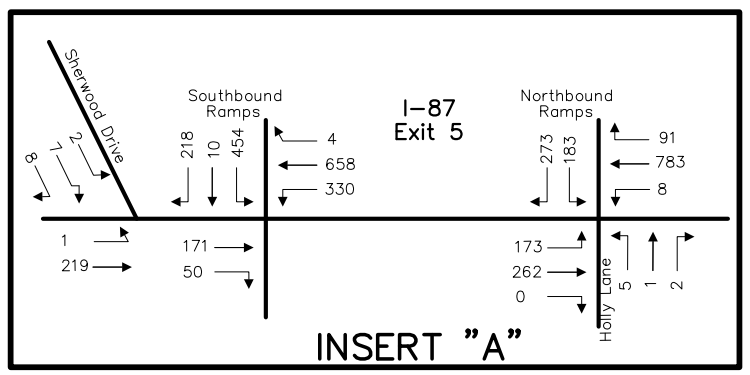

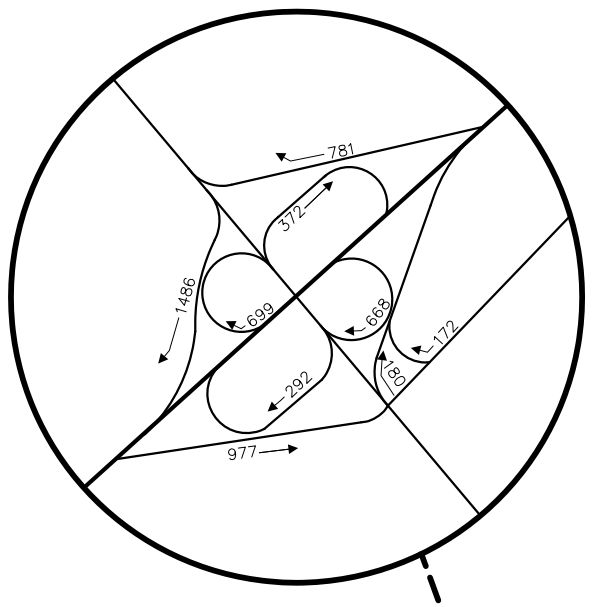

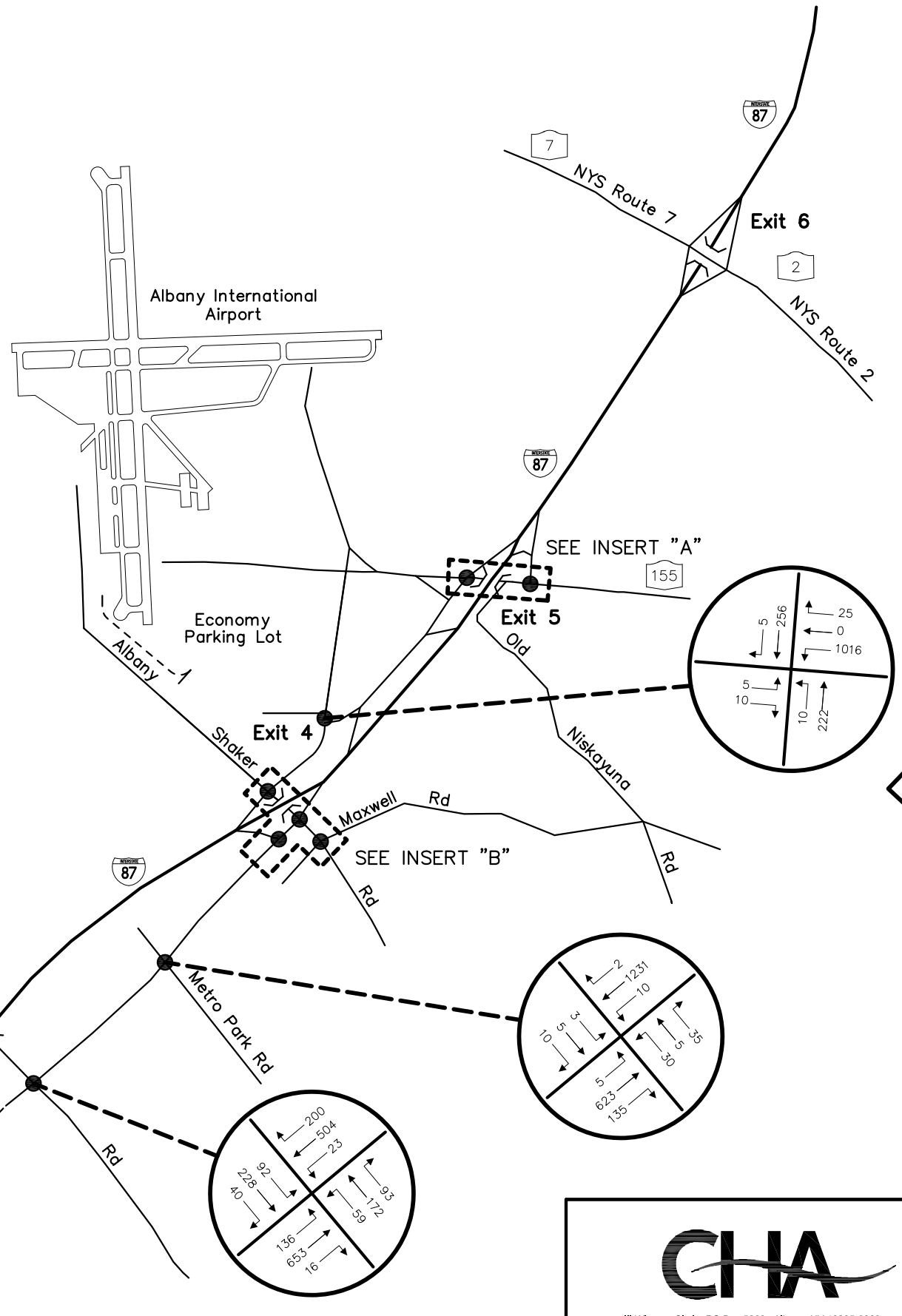

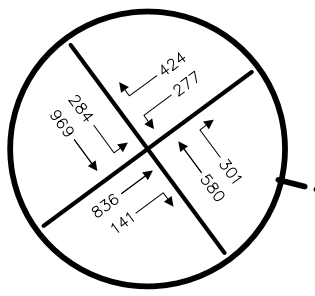

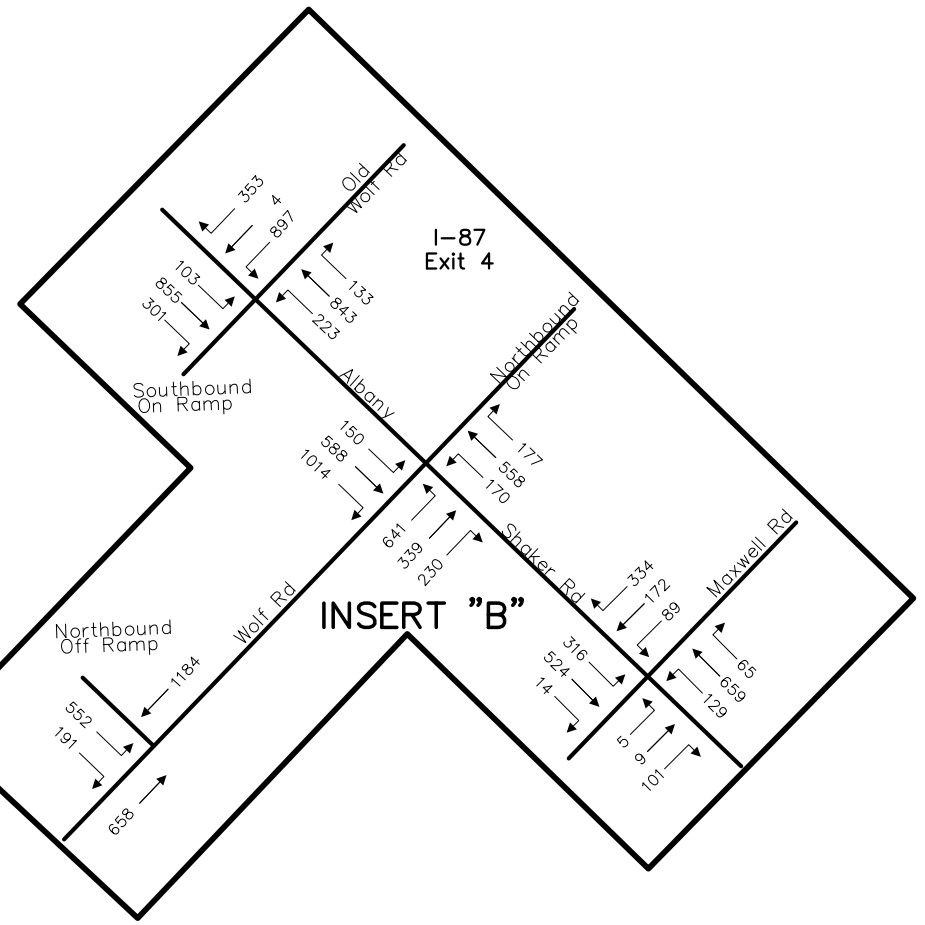

GRID NORTH

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2016 NO–BUILD AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F–3

DATE: 1/12

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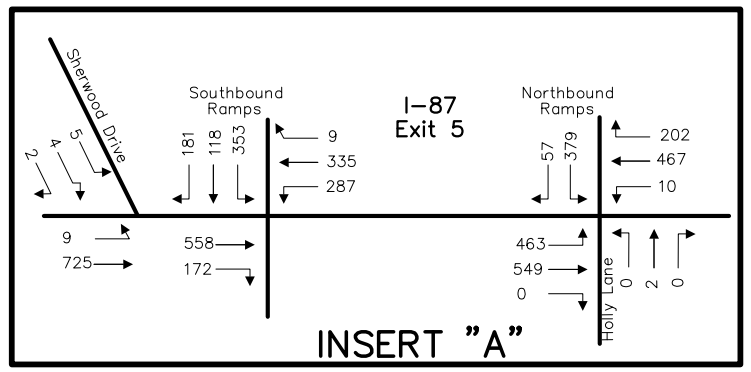

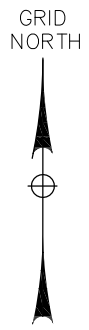

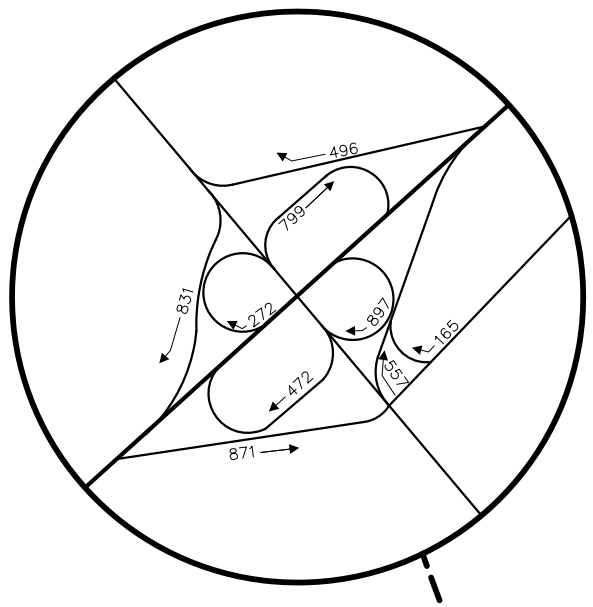

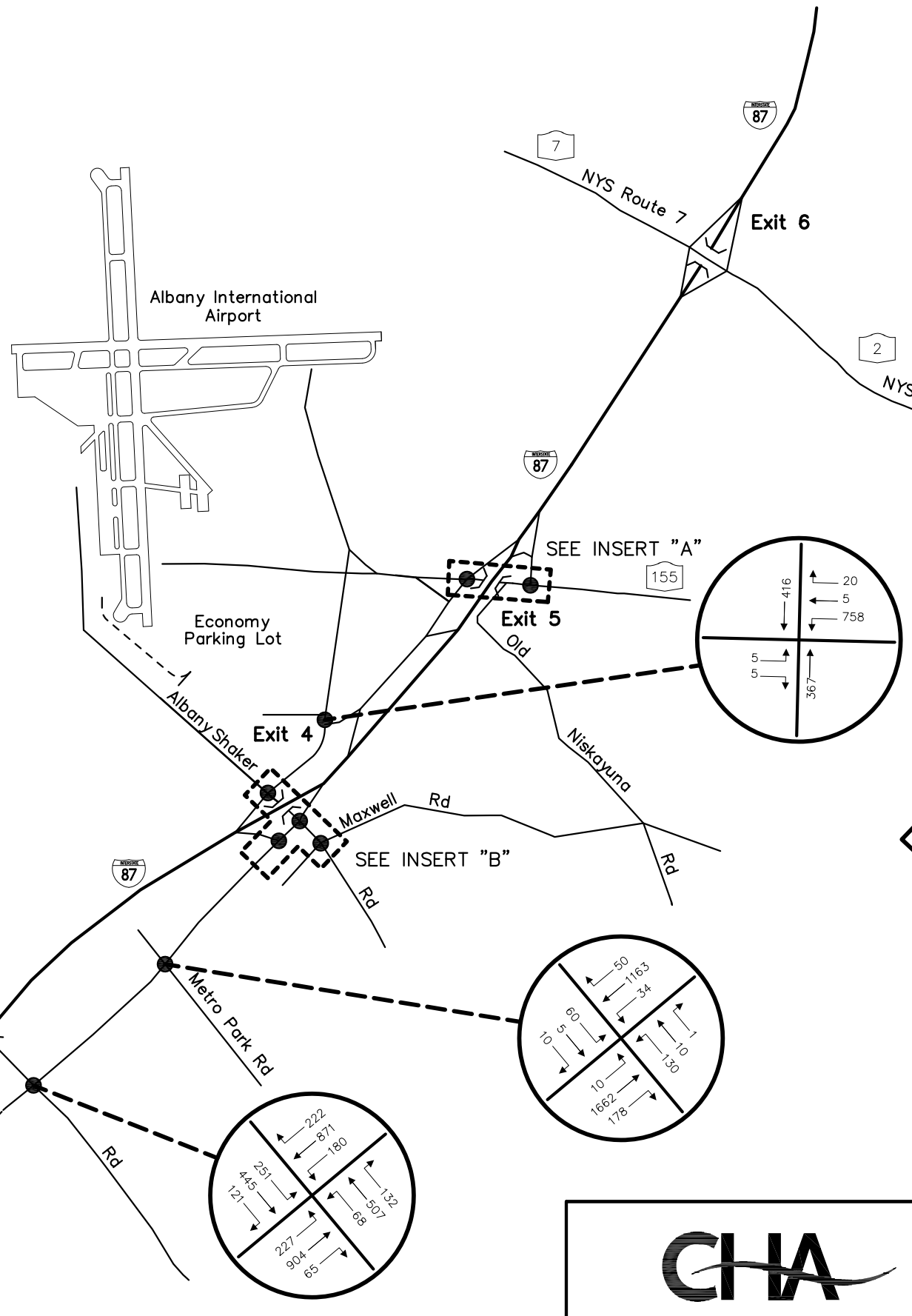

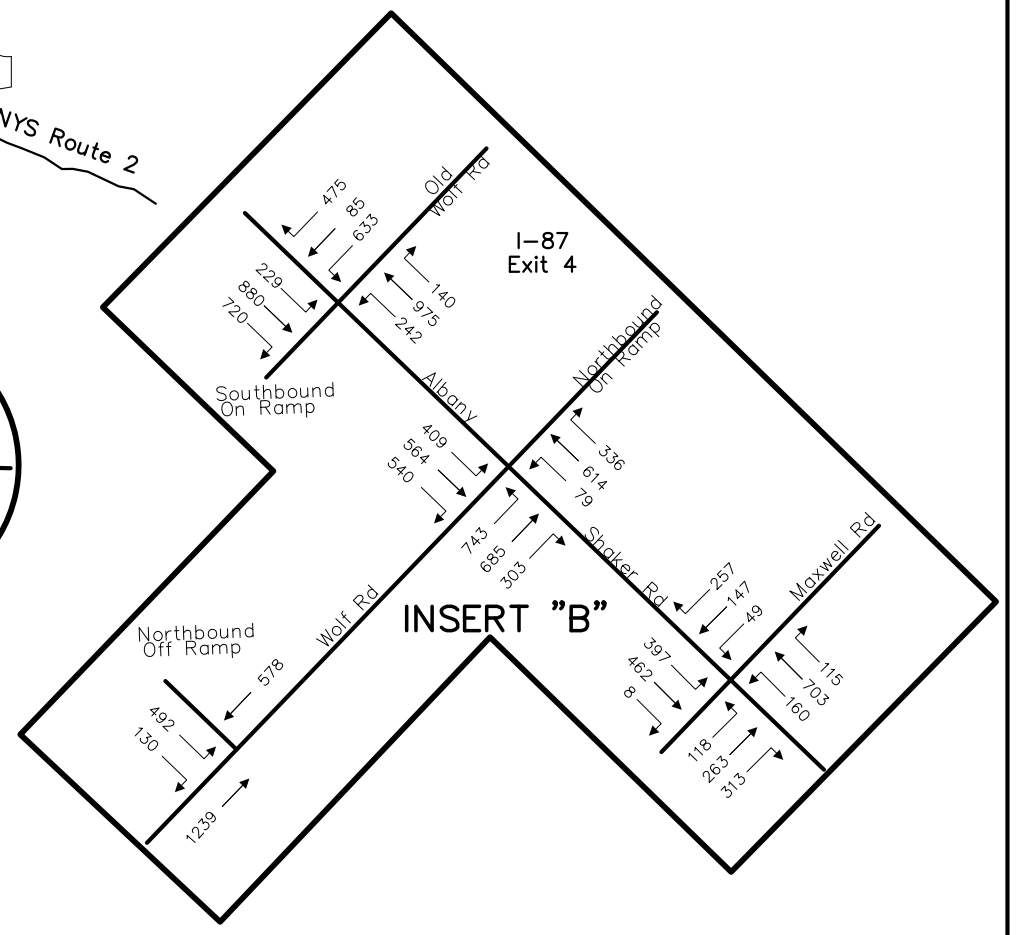

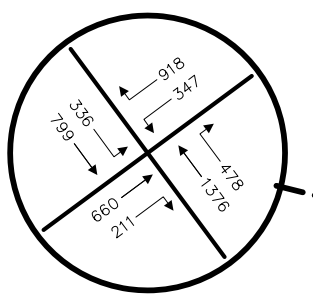

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2016 NO-BUILD PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

FIGURE F-4

DATE: 1/12

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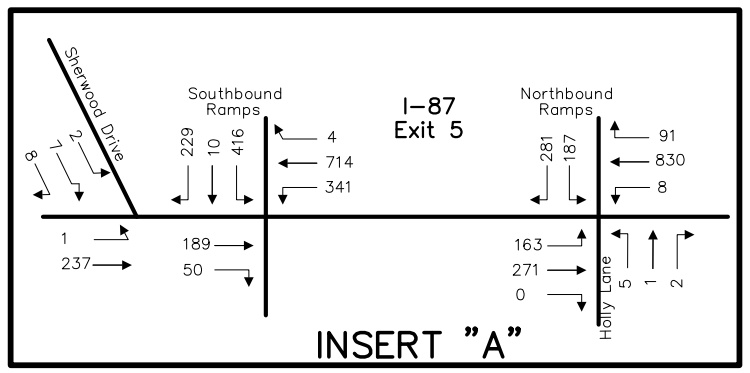

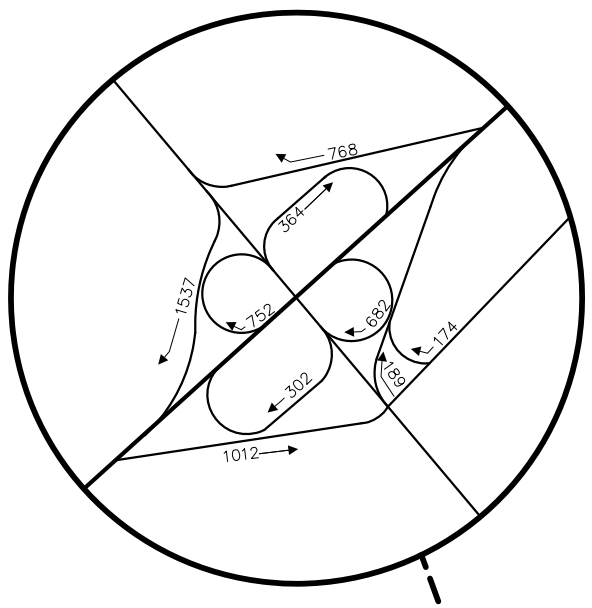

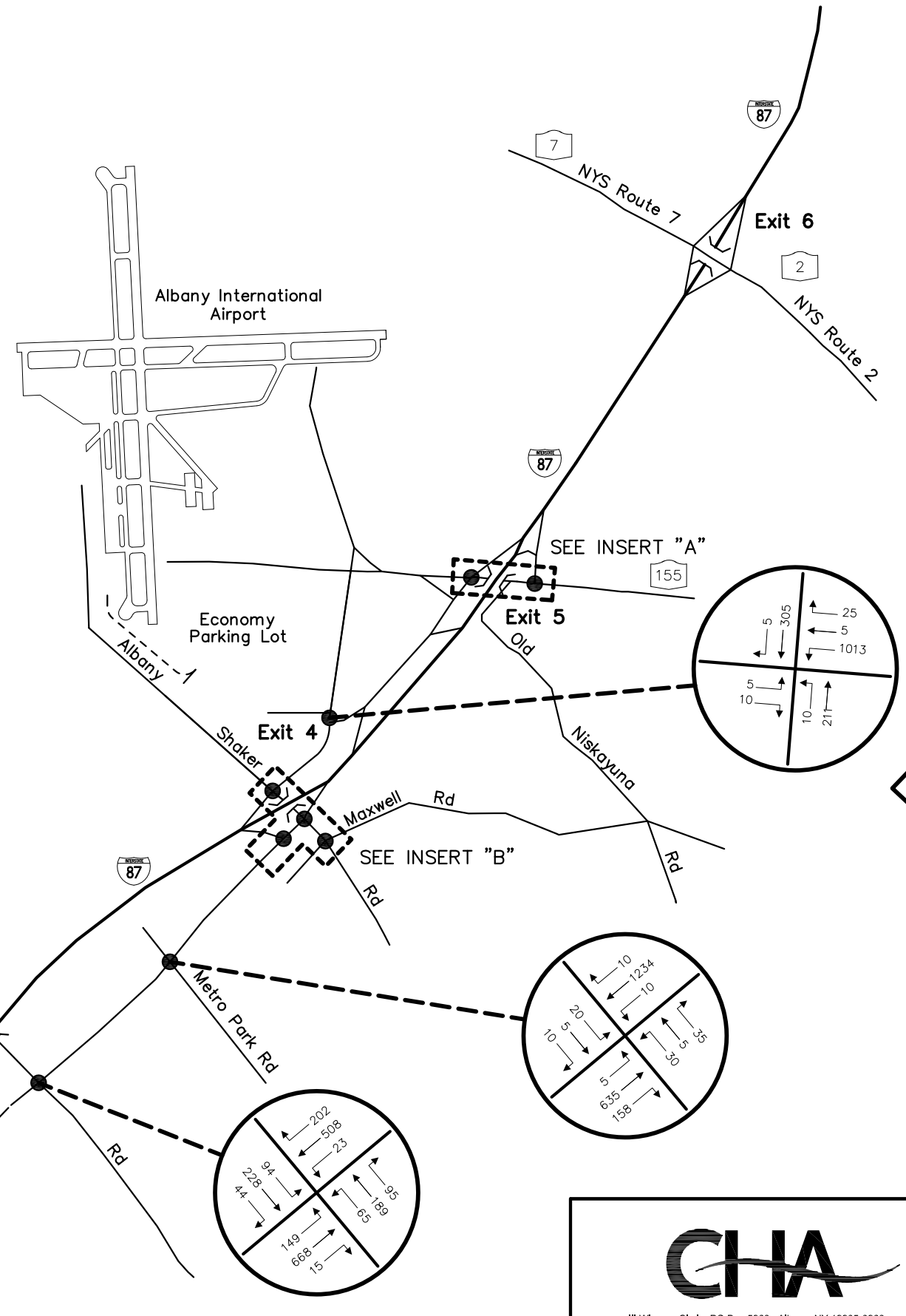

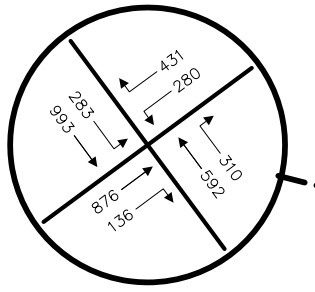

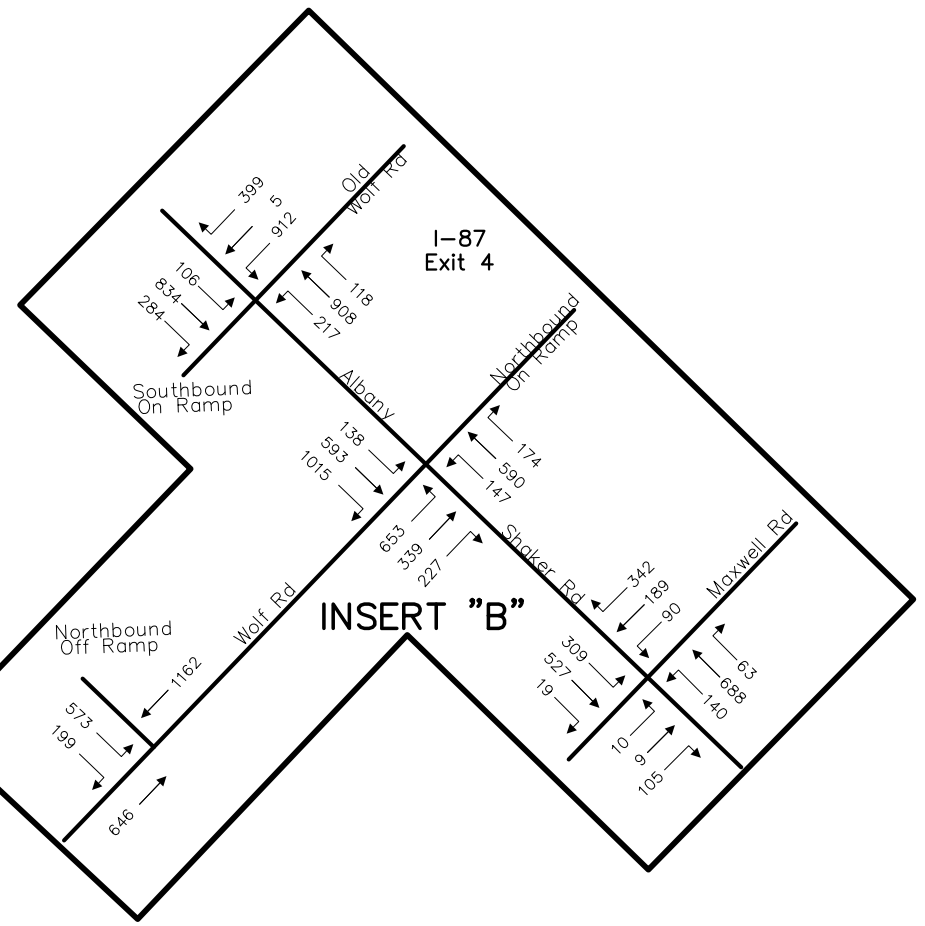

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2026 NO–BUILD AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F–5

DATE: 1/12

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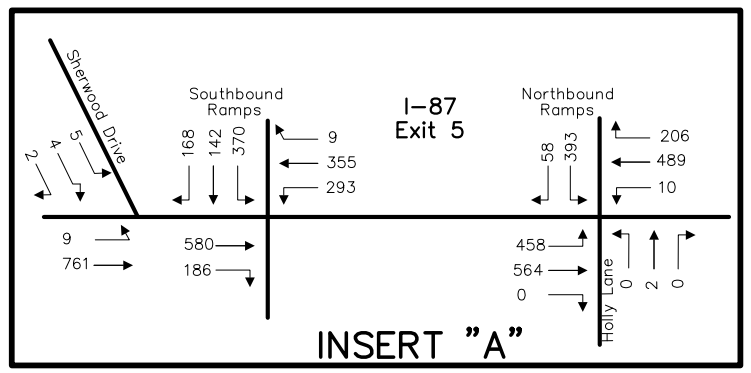

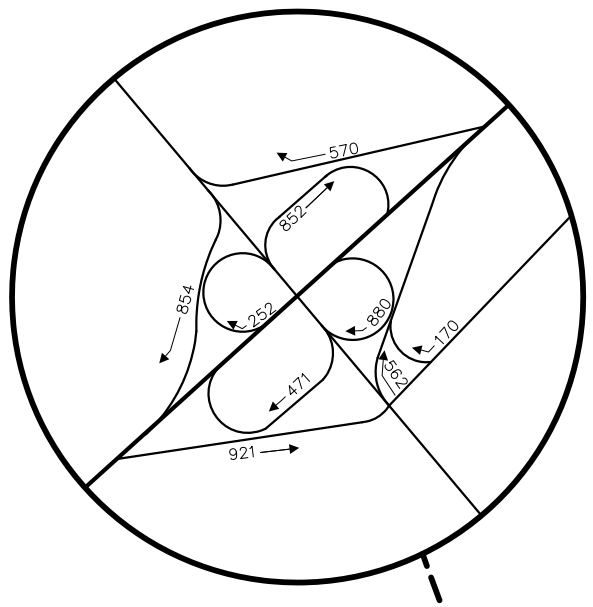

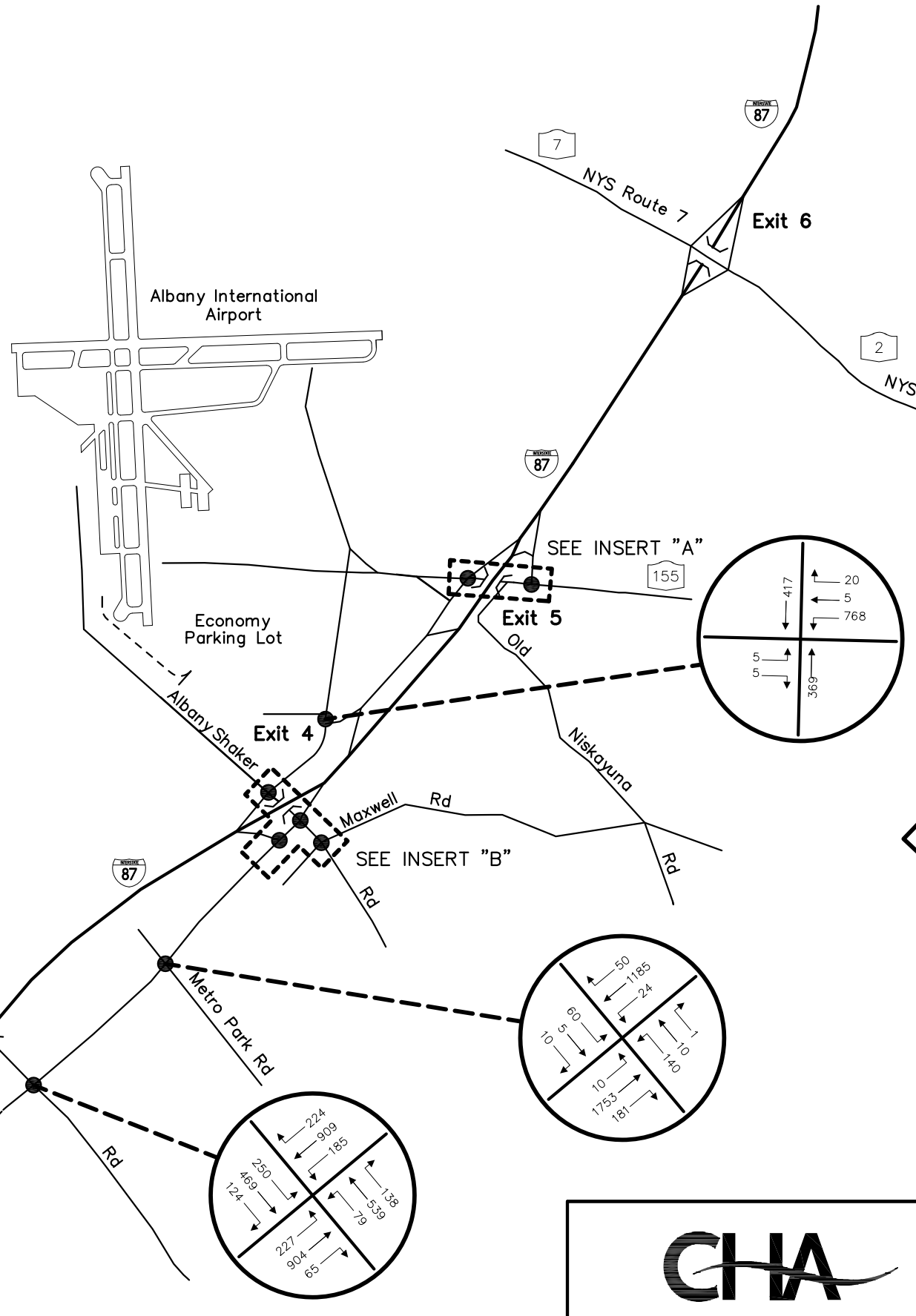

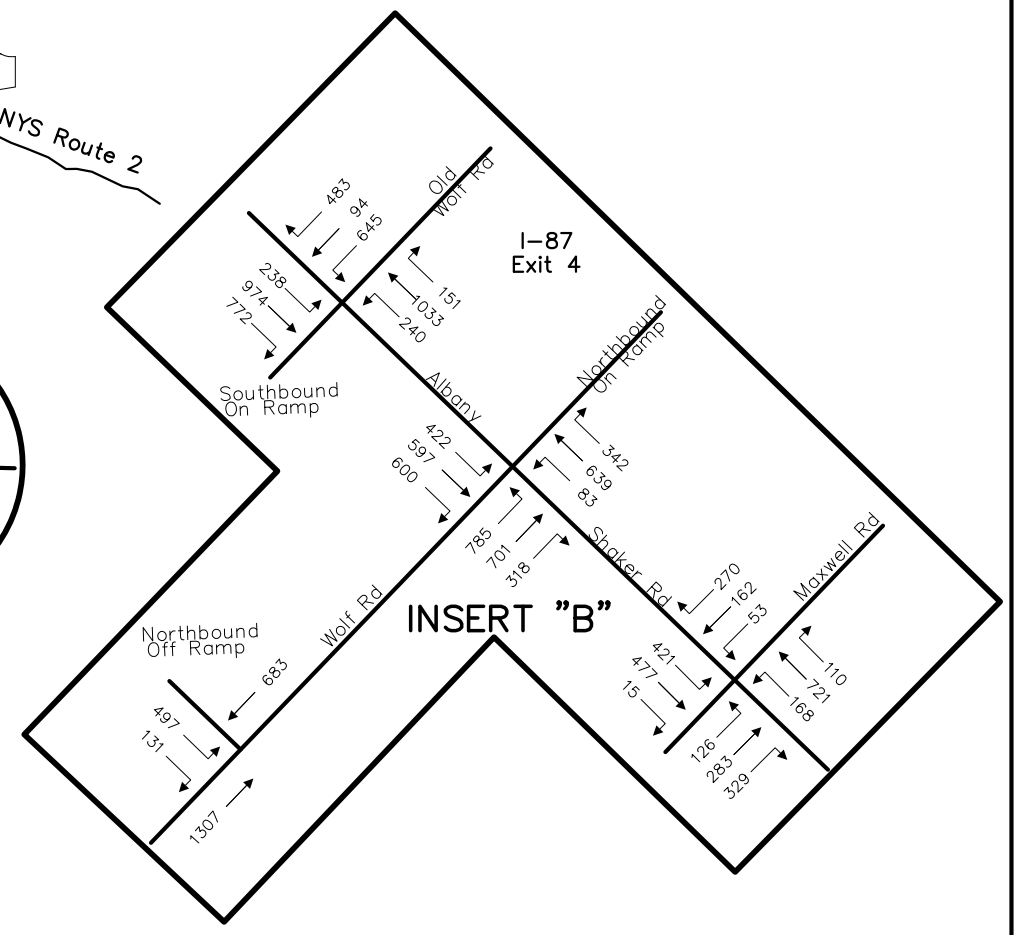

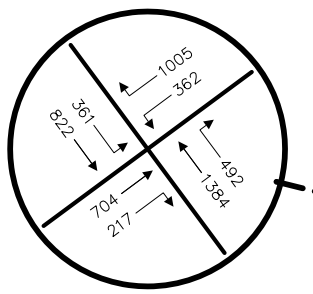

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2026 NO-BUILD PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

FIGURE F-6

DATE: 1/12

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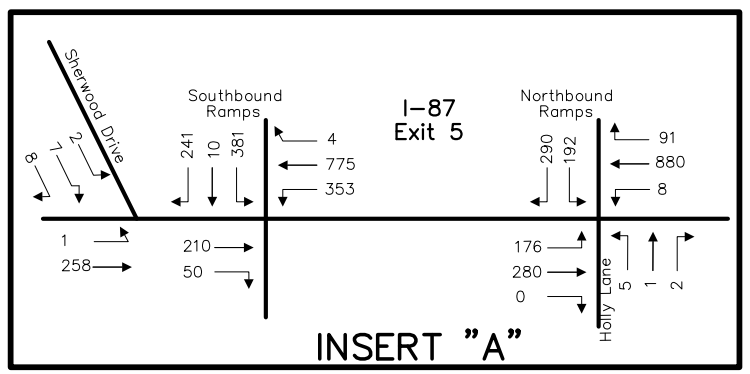

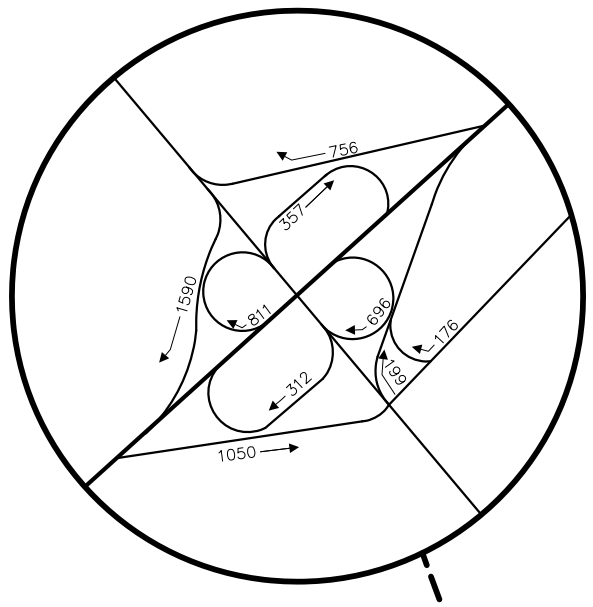

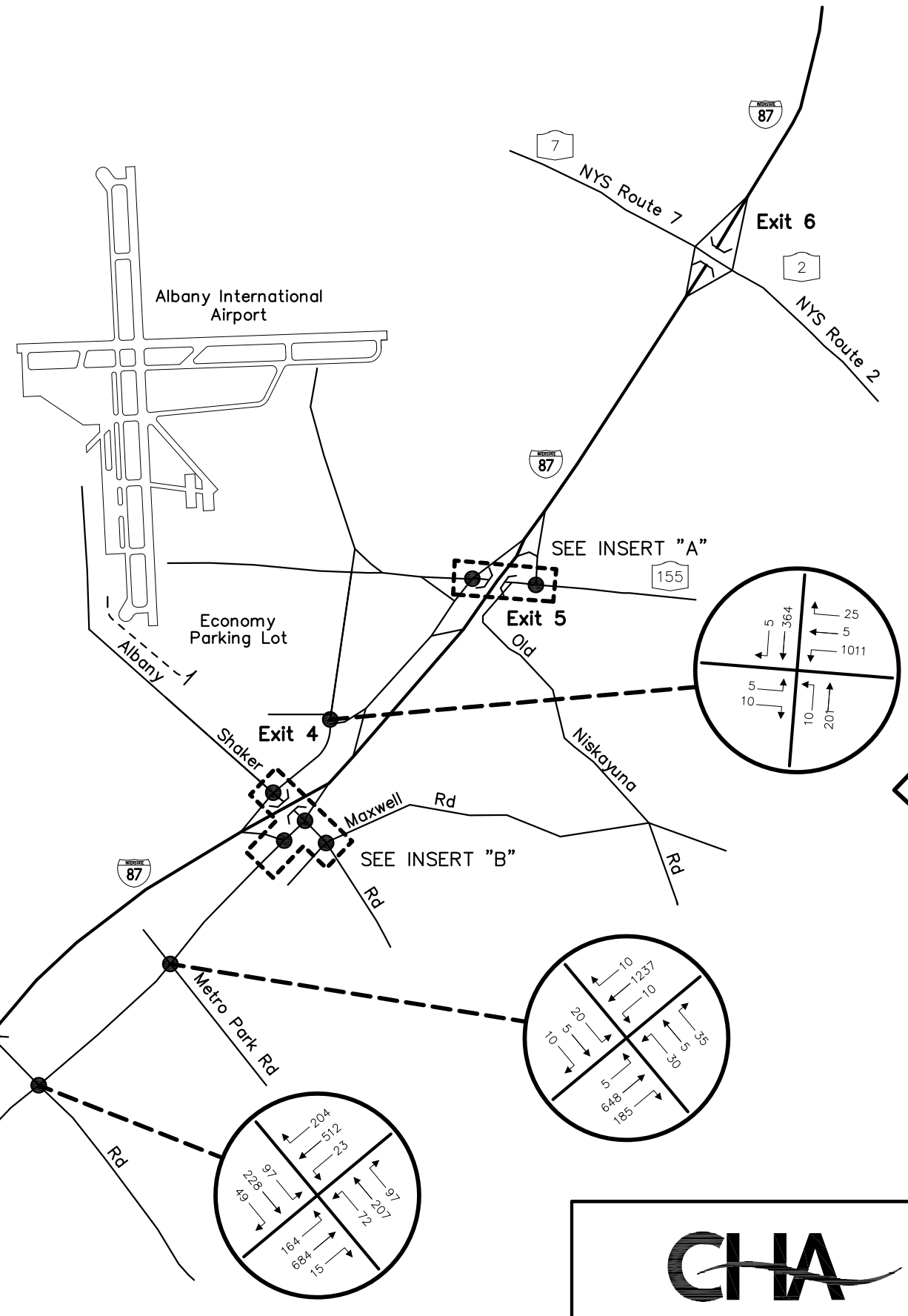

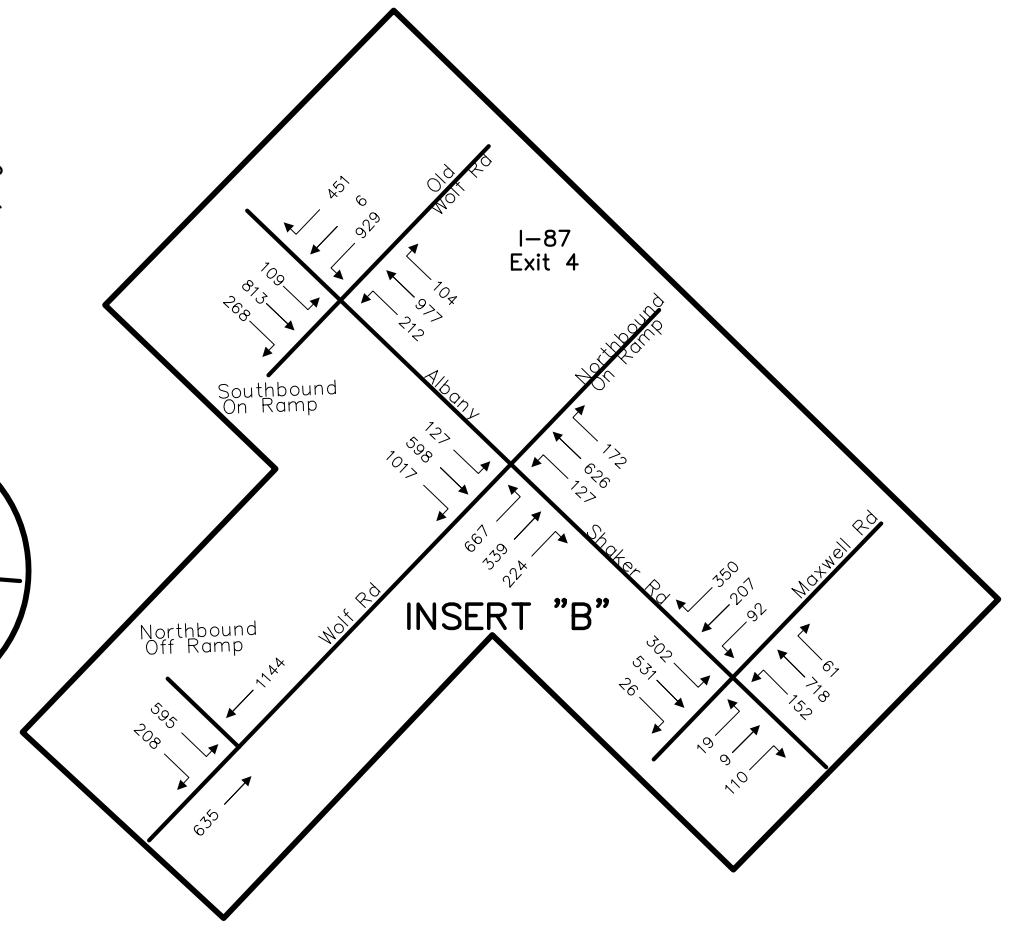

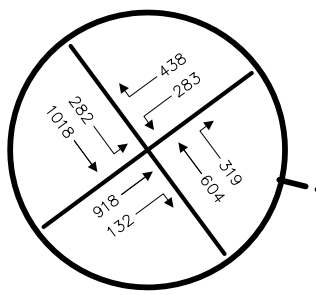

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2036 NO–BUILD AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F–7

DATE: 1/12

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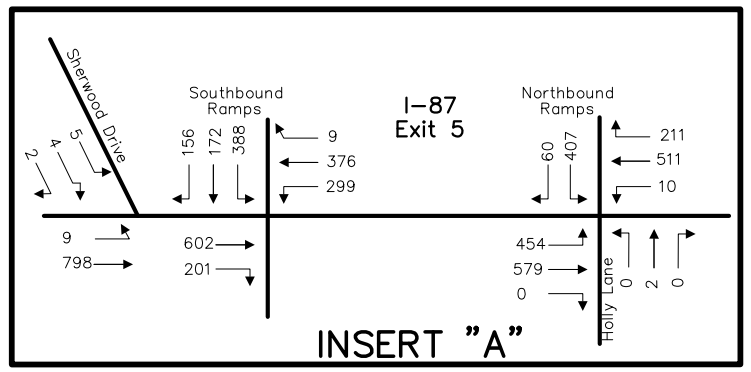

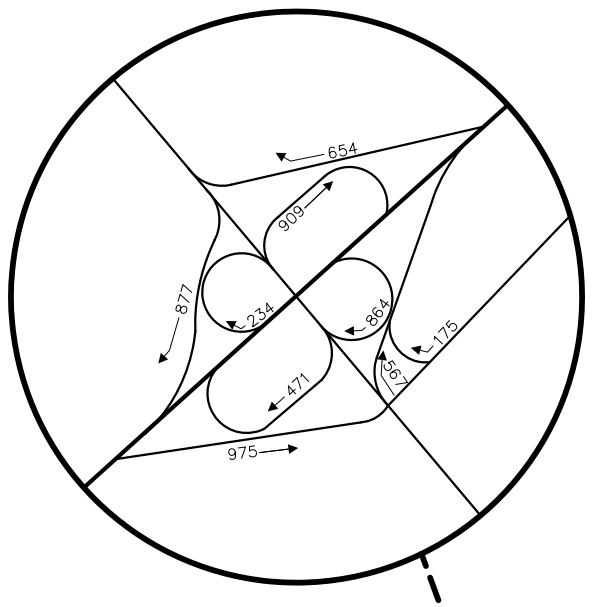

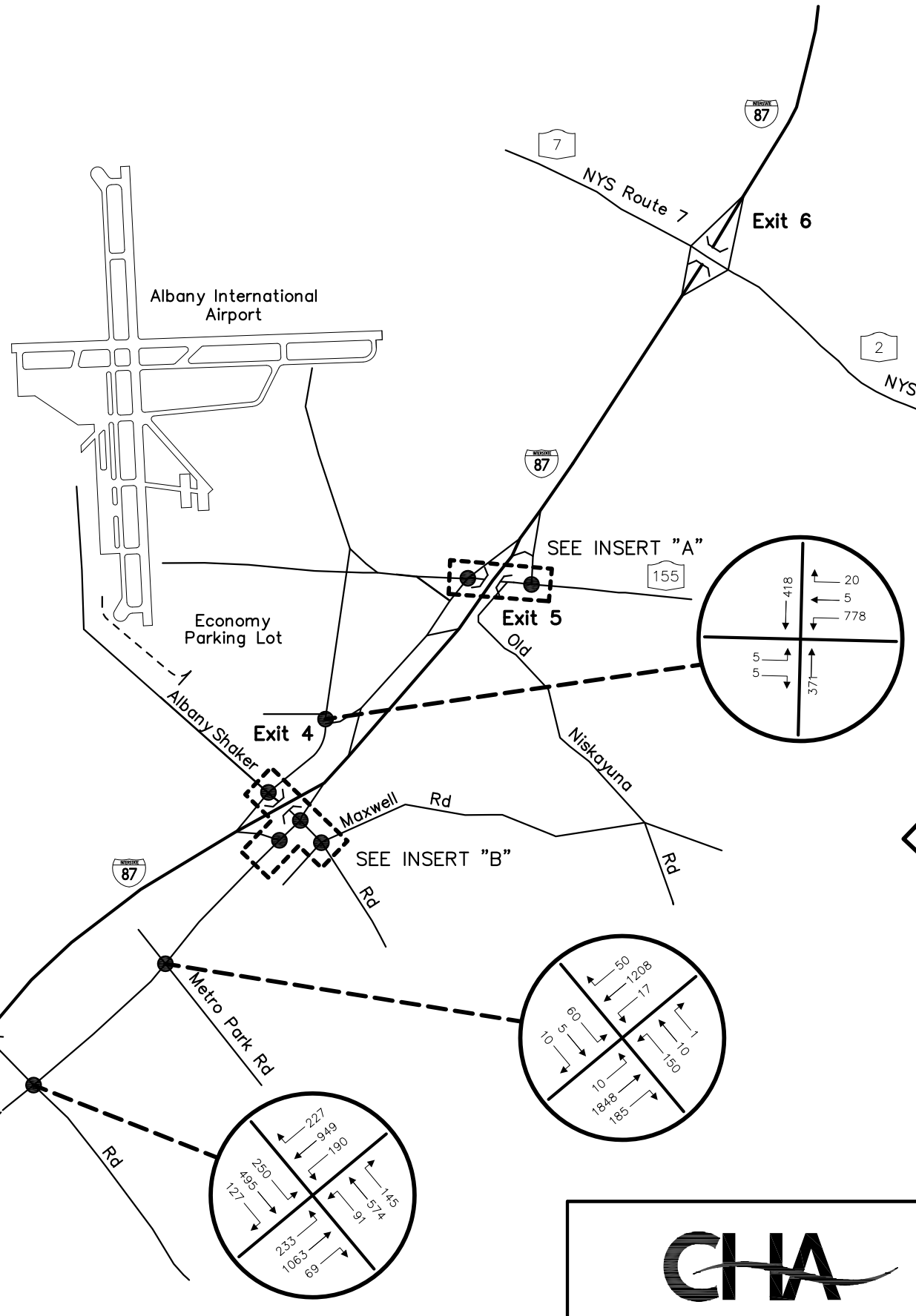

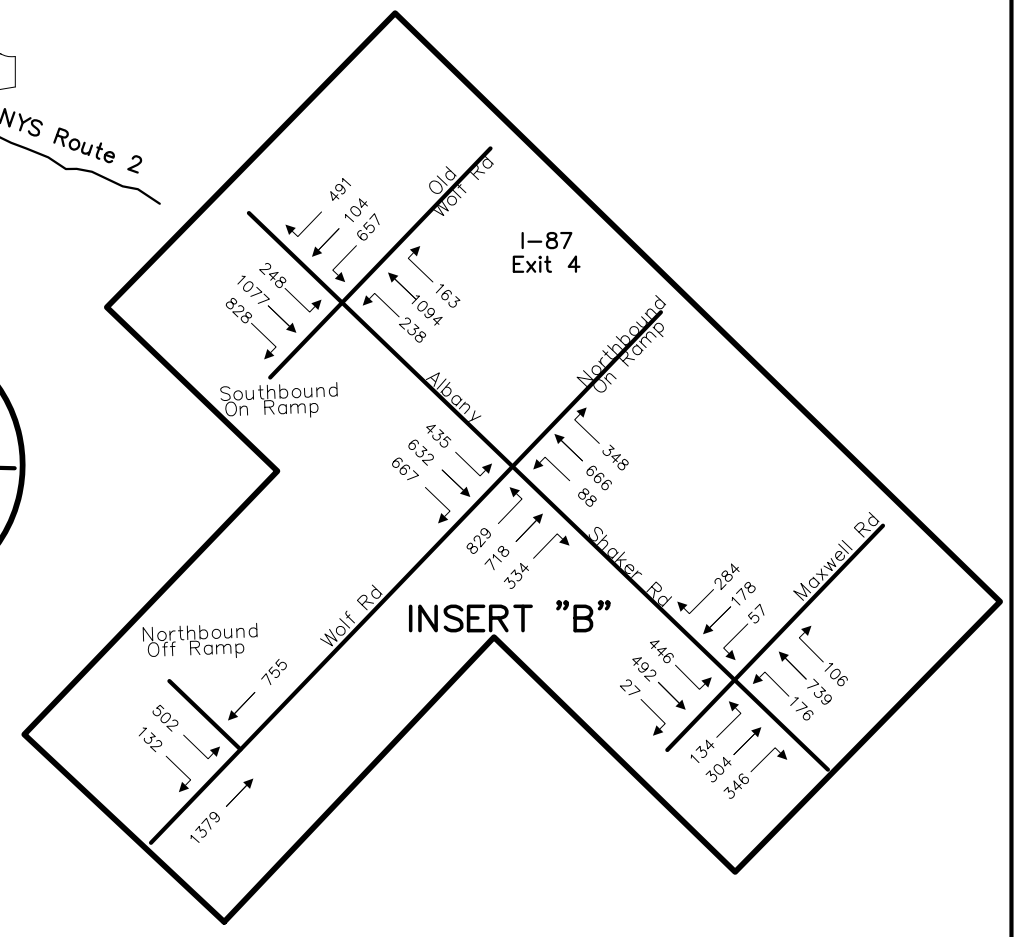

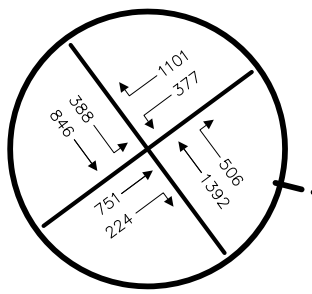

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2036 NO-BUILD PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

FIGURE F-8

DATE: 1/12

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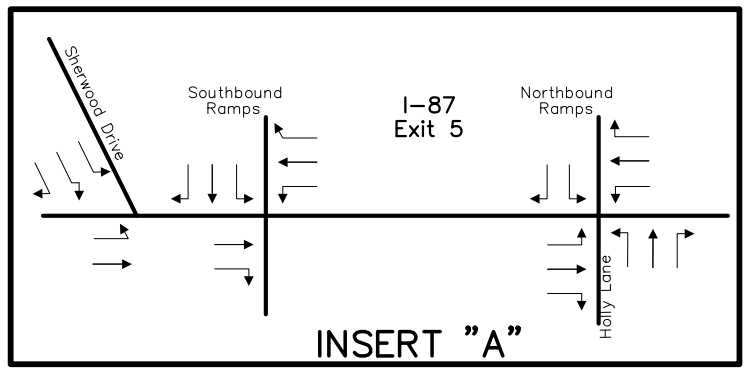

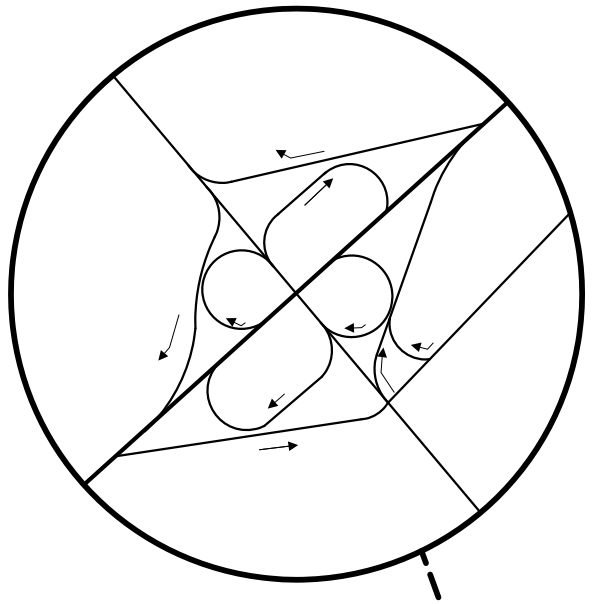

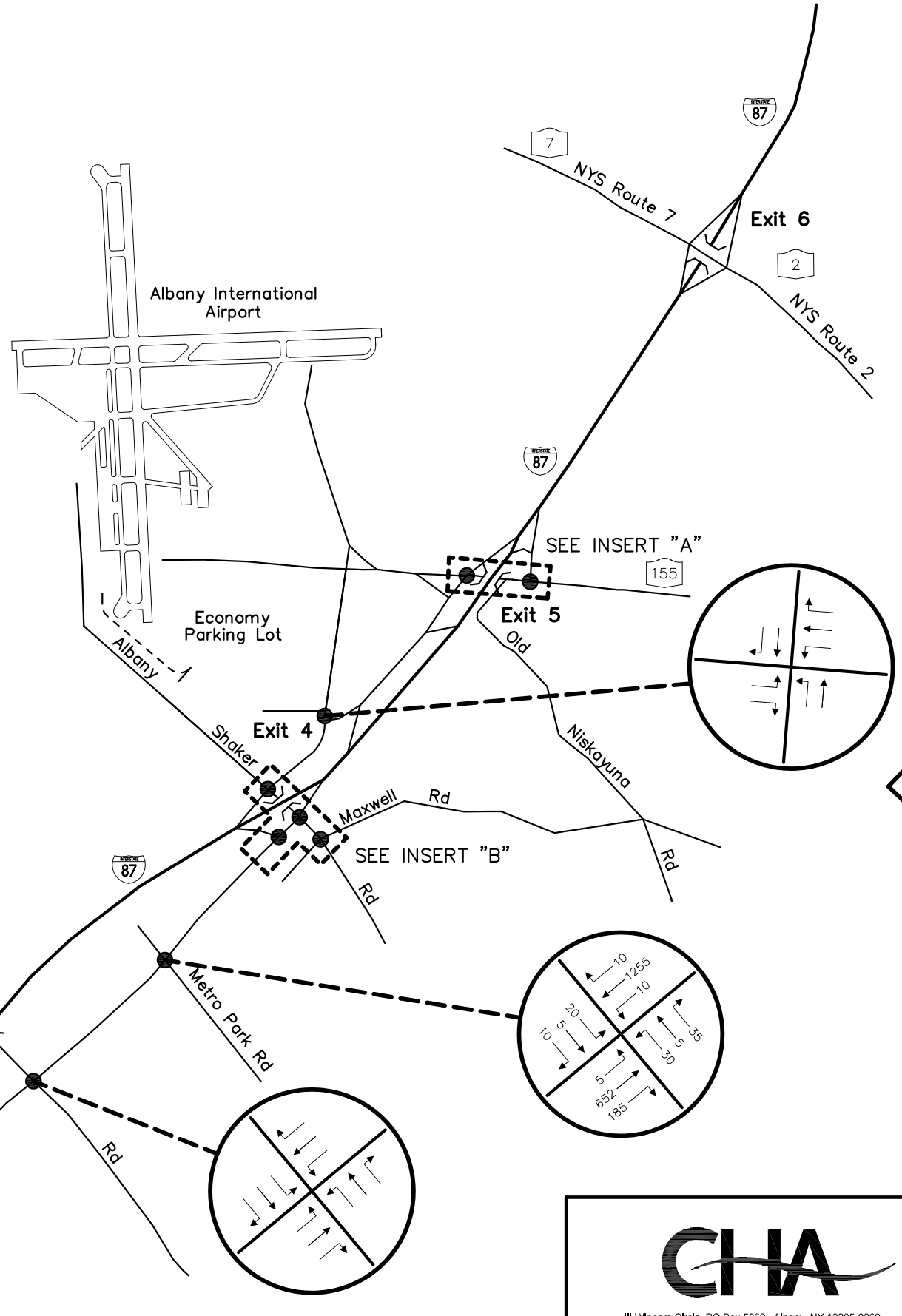

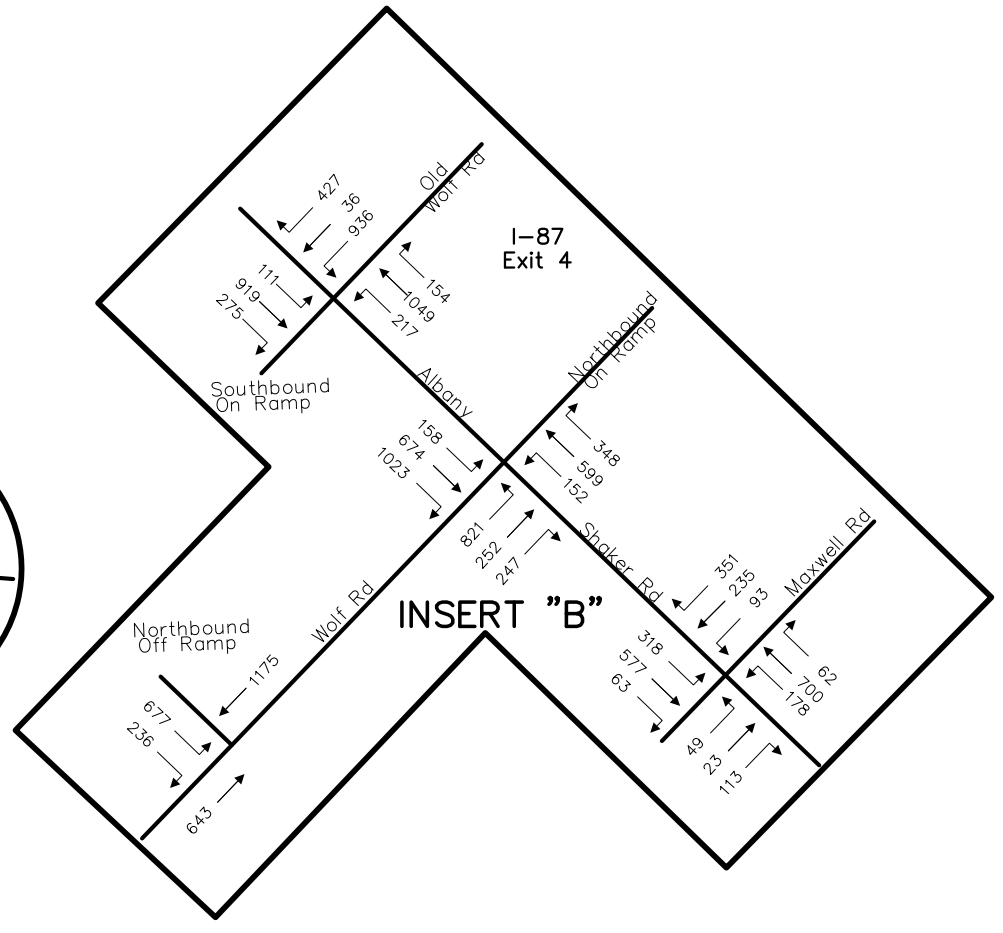

GRID NORTH

NOTE: NOT TO SCALE

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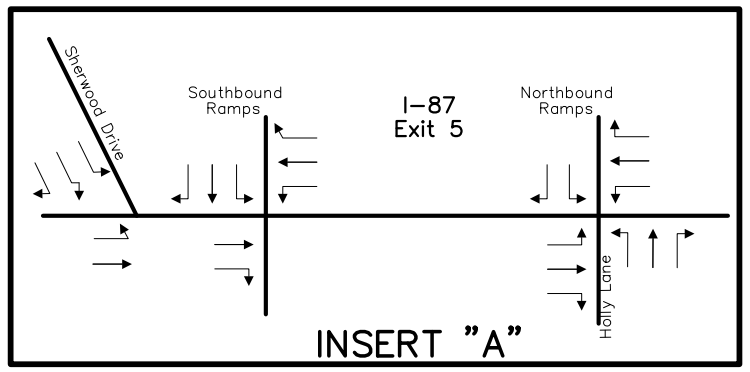
2046 NO-BUILD AM PEAK HOUR TRAFFIC VOLUMES

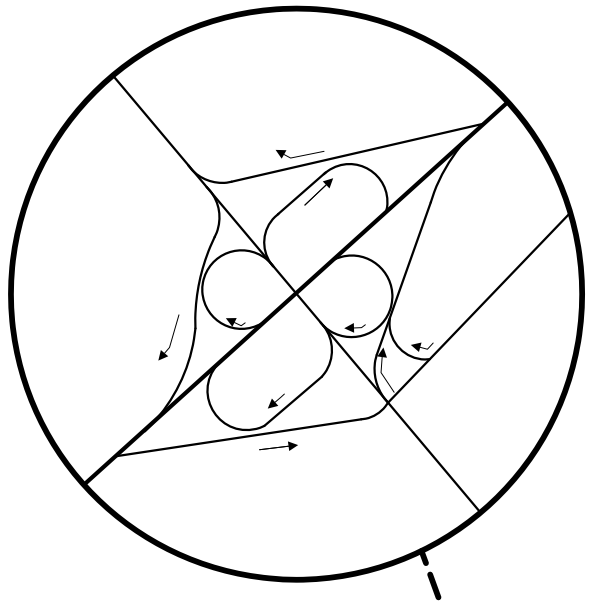
INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

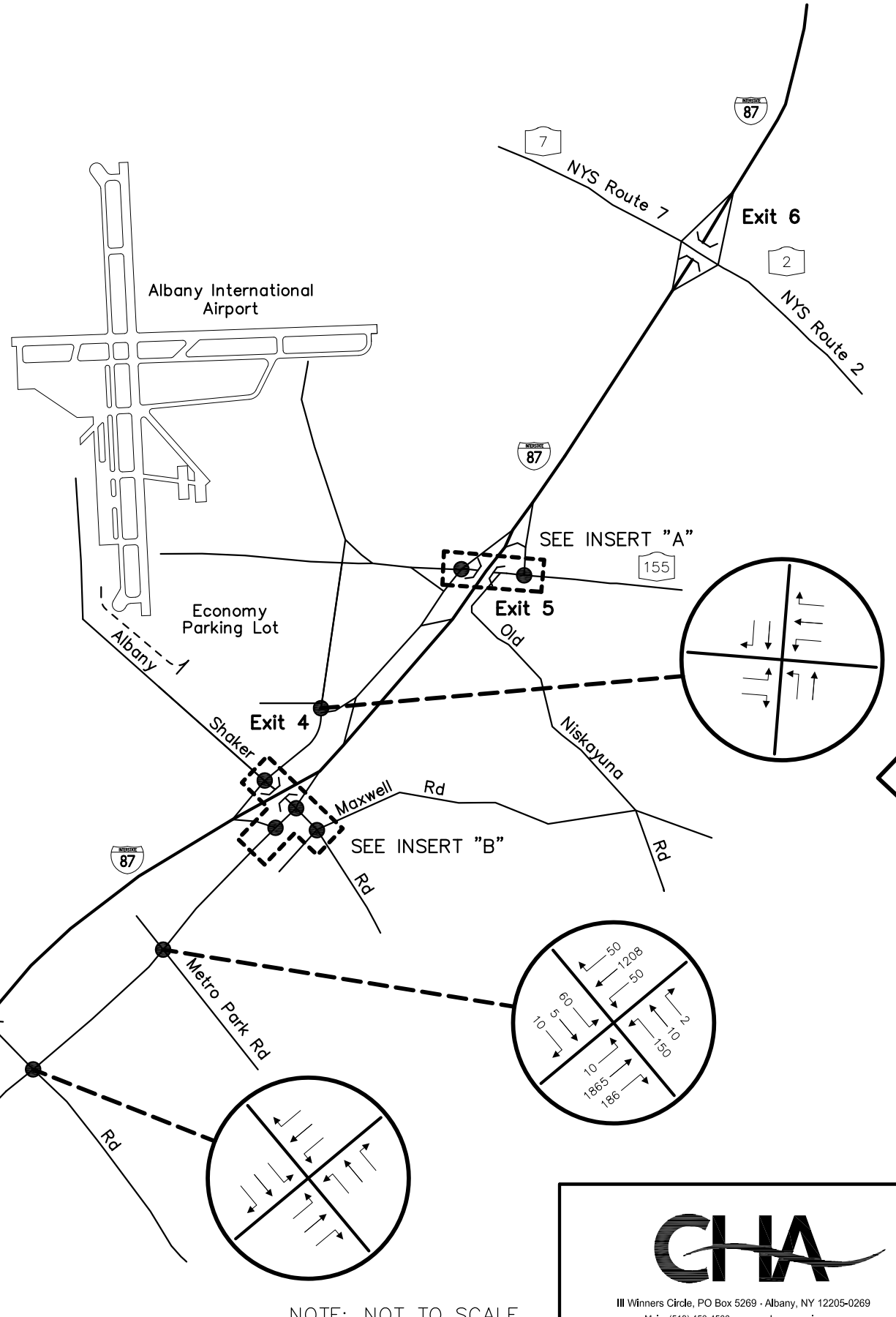
FIGURE F-9

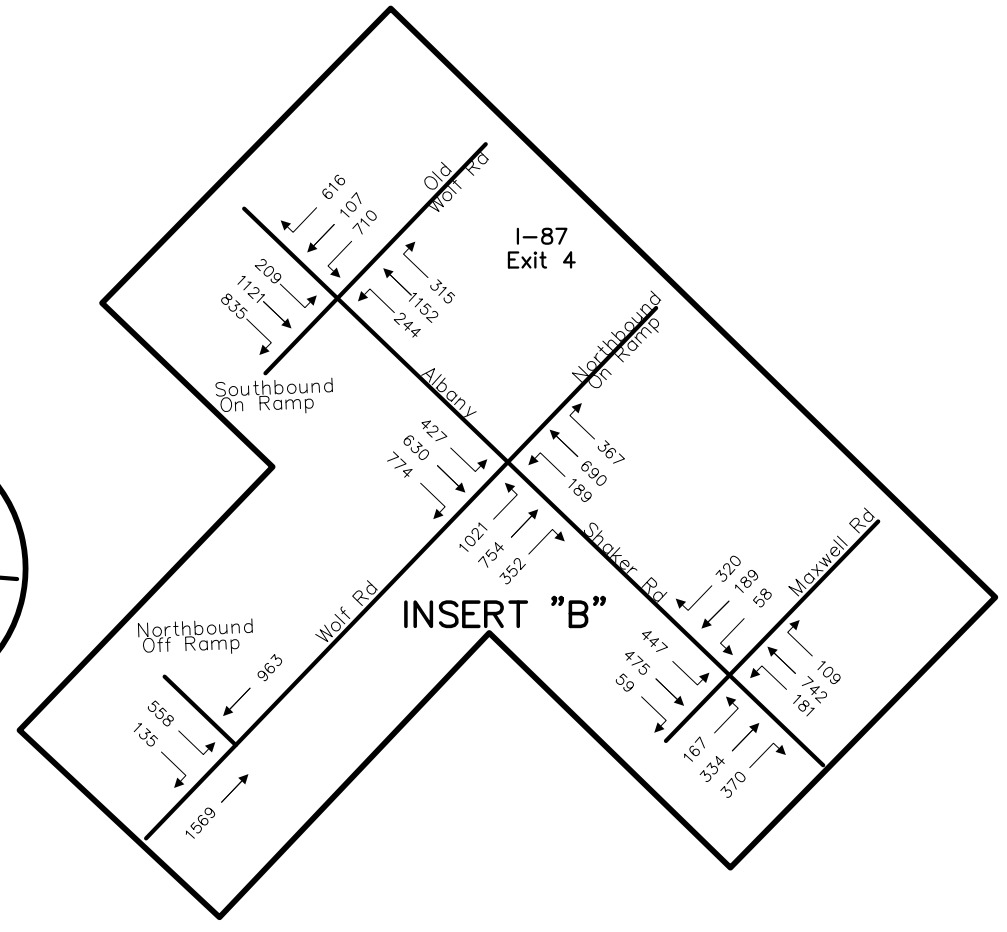
DATE: 1/12

Saved: 12/21/2011 1:53:08 PM PLotted: 1/9/2012 5:05:49 PM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2046 AM NO-BUILD.DWG









GRID NORTH

NOTE: NOT TO SCALE

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2046 NO–BUILD PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F–10

DATE: 1/12

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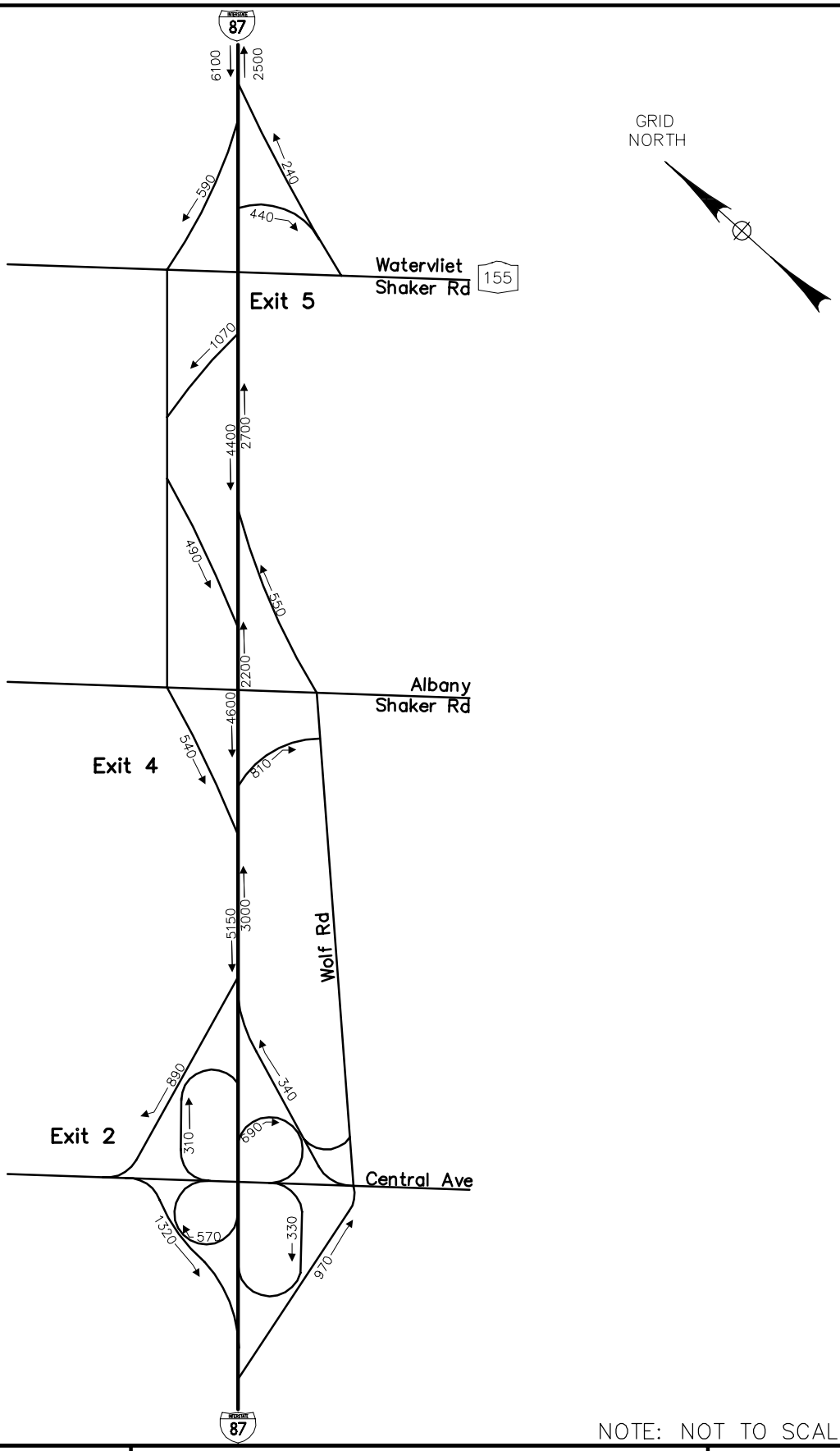

NOTE: NOT TO SCALE

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2009 EXISTING HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–11

DATE: 8/13

Saved: 1/9/2012 5:34:04 PM PLotted: 8/27/2013 10:35:40 AM User: Gray, Timmolyn
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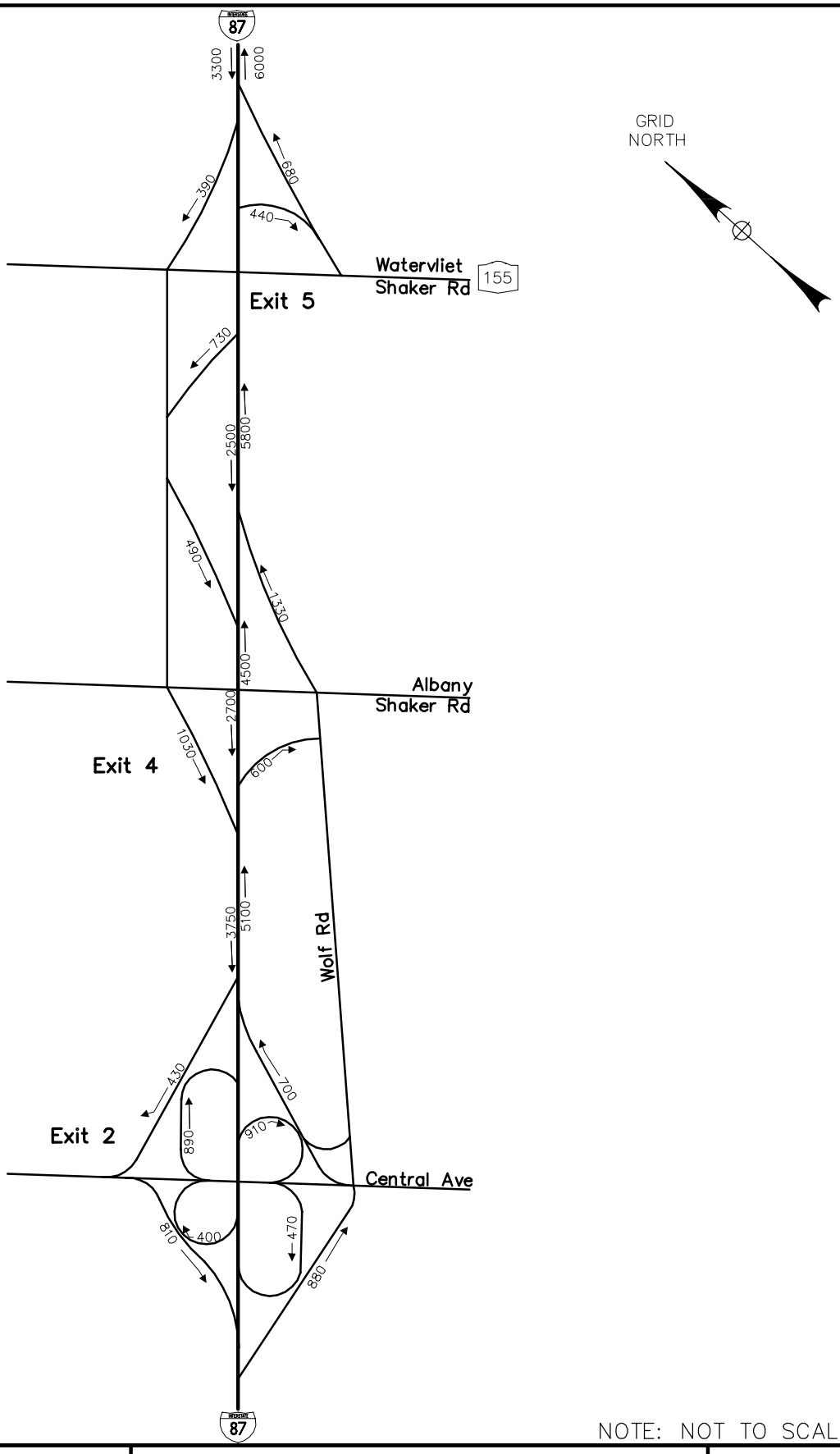

NOTE: NOT TO SCALE

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2009 EXISTING HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–12

DATE: 8/13

Saved: 1/9/2012 5:33:56 PM PLotted: 8/27/2013 10:37:57 AM User: Gray, Timmolyn
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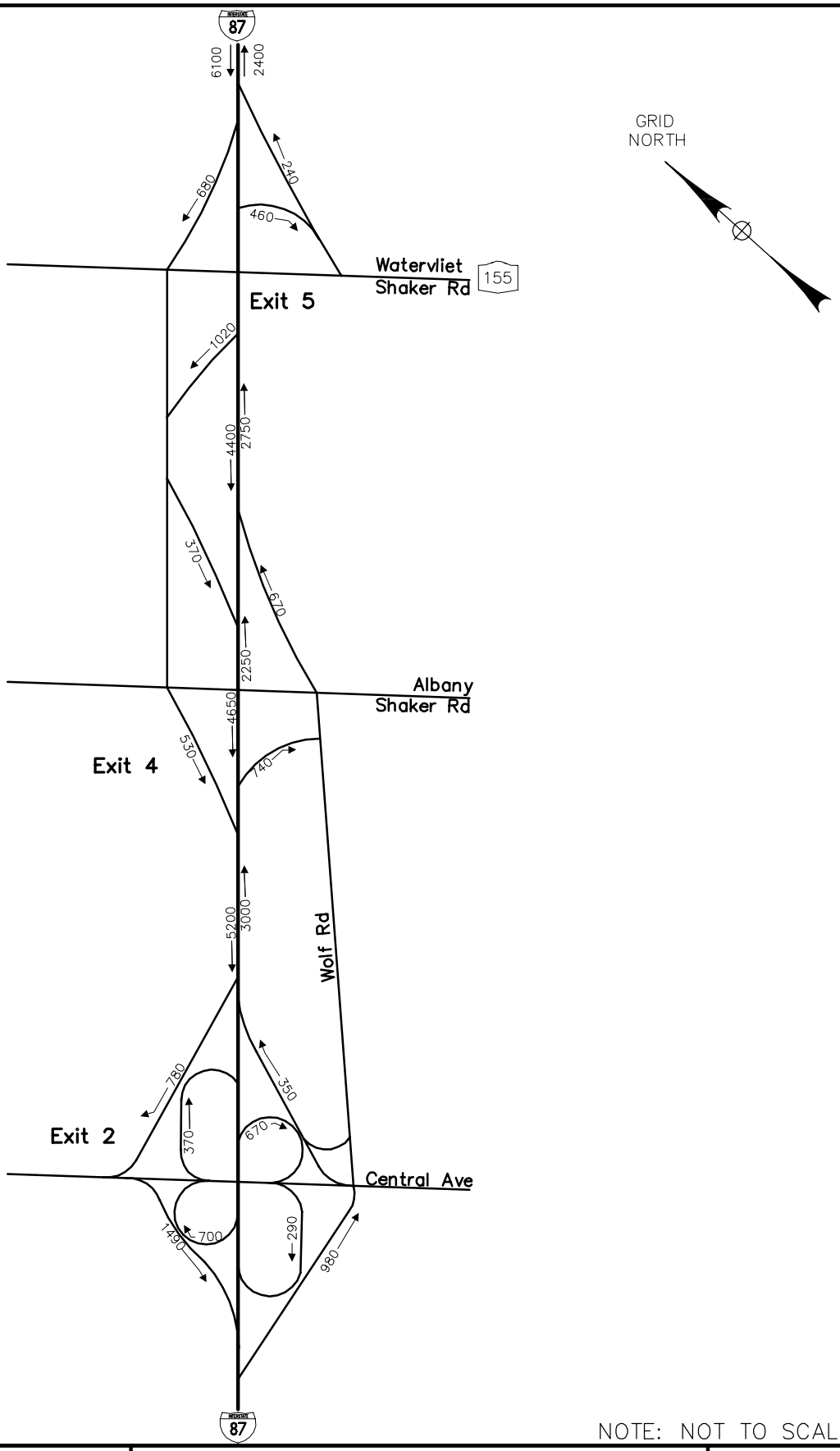

NOTE: NOT TO SCALE

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2016 NO-BUILD HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-13

DATE: 8/13

Saved: 8/27/2013 10:42:12 AM PLotted: 8/27/2013 10:42:17 AM User: Gray, Timmolyn
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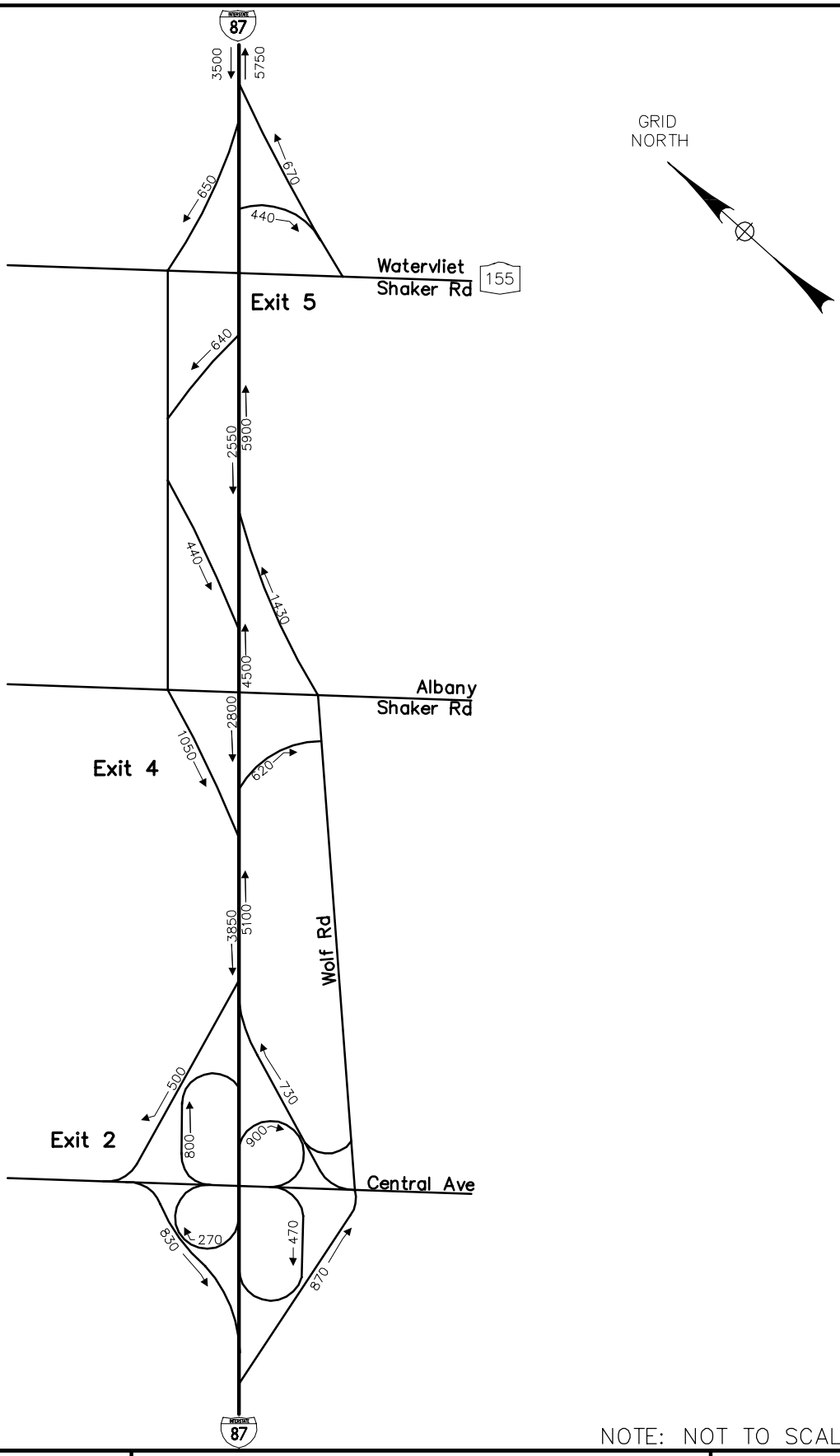

NOTE: NOT TO SCALE

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2016 NO-BUILD HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-14

DATE: 8/13

Saved: 1/9/2012 5:16:40 PM PLotted: 8/27/2013 10:44:02 AM User: Gray, Timmalyn
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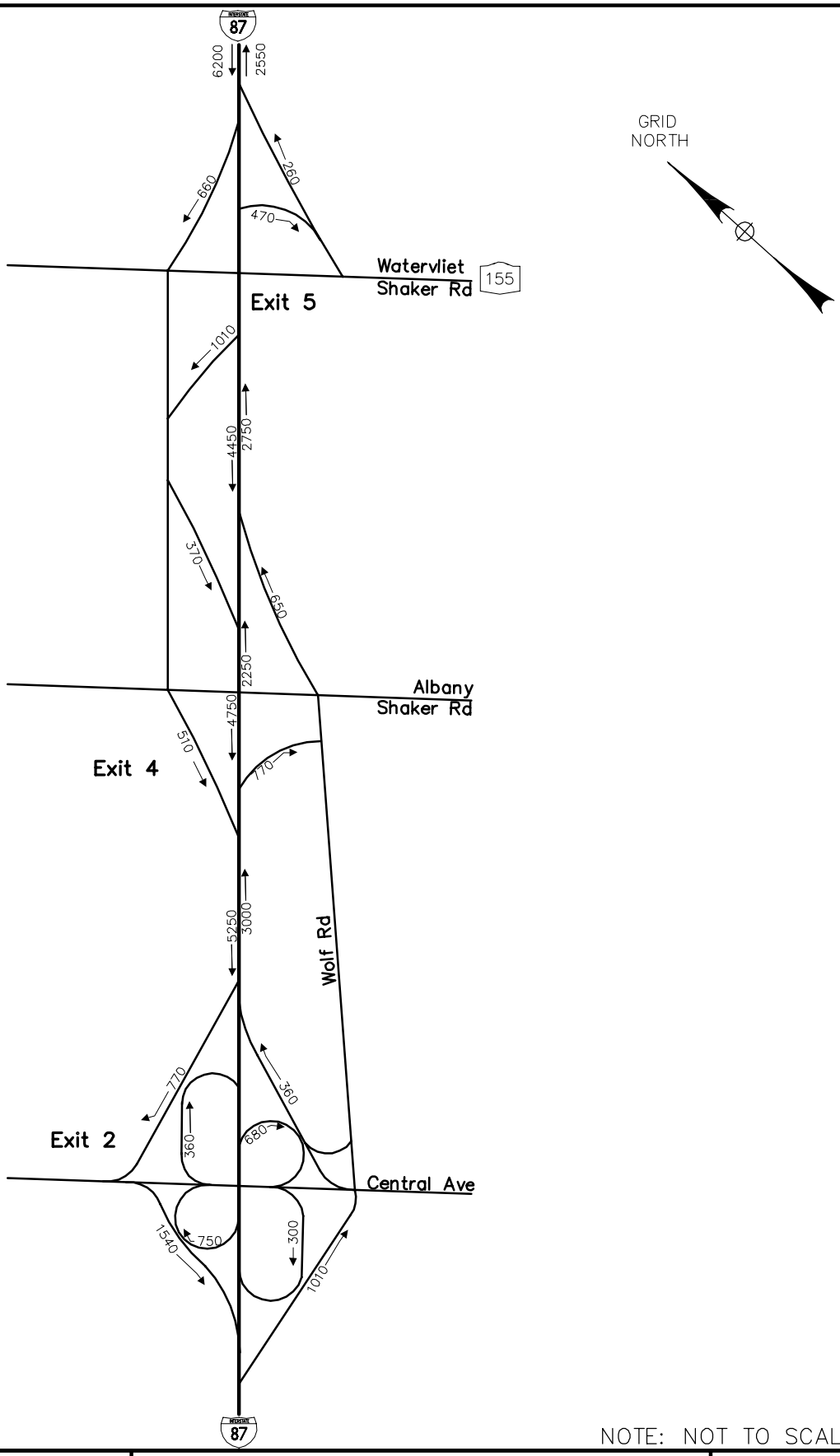

NOTE: NOT TO SCALE

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2026 NO-BUILD HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-15

DATE: 8/13

Saved: 1/9/2012 6:16:19 PM Plotted: 8/27/2013 10:55:37 AM User: Gray, Timmolyn
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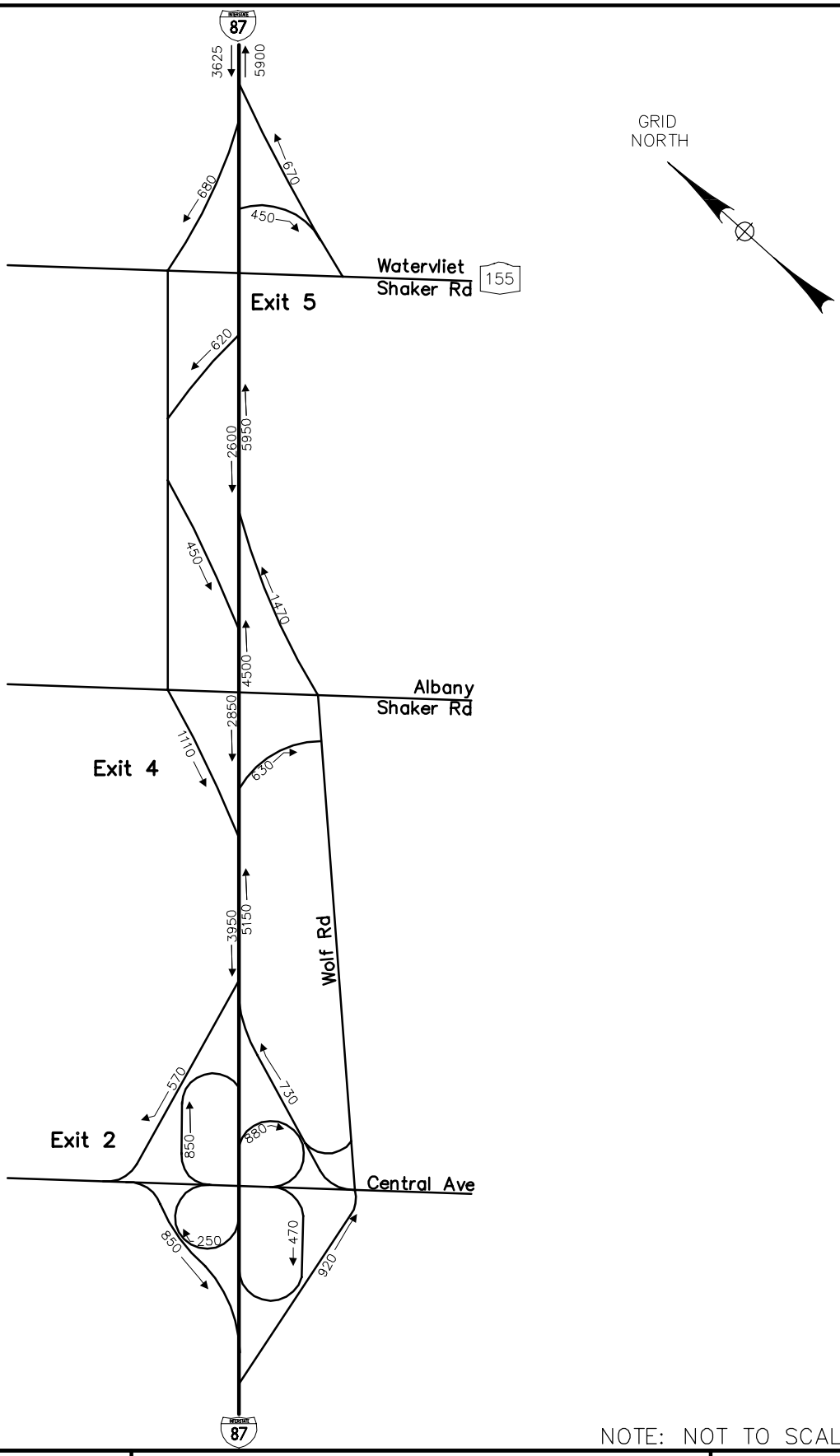

NOTE: NOT TO SCALE

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2026 NO-BUILD HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-16

DATE: 8/13

Saved: 1/9/2012 6:15:54 PM PLotted: 8/27/2013 10:57:21 AM User: Gray, Timmolyn
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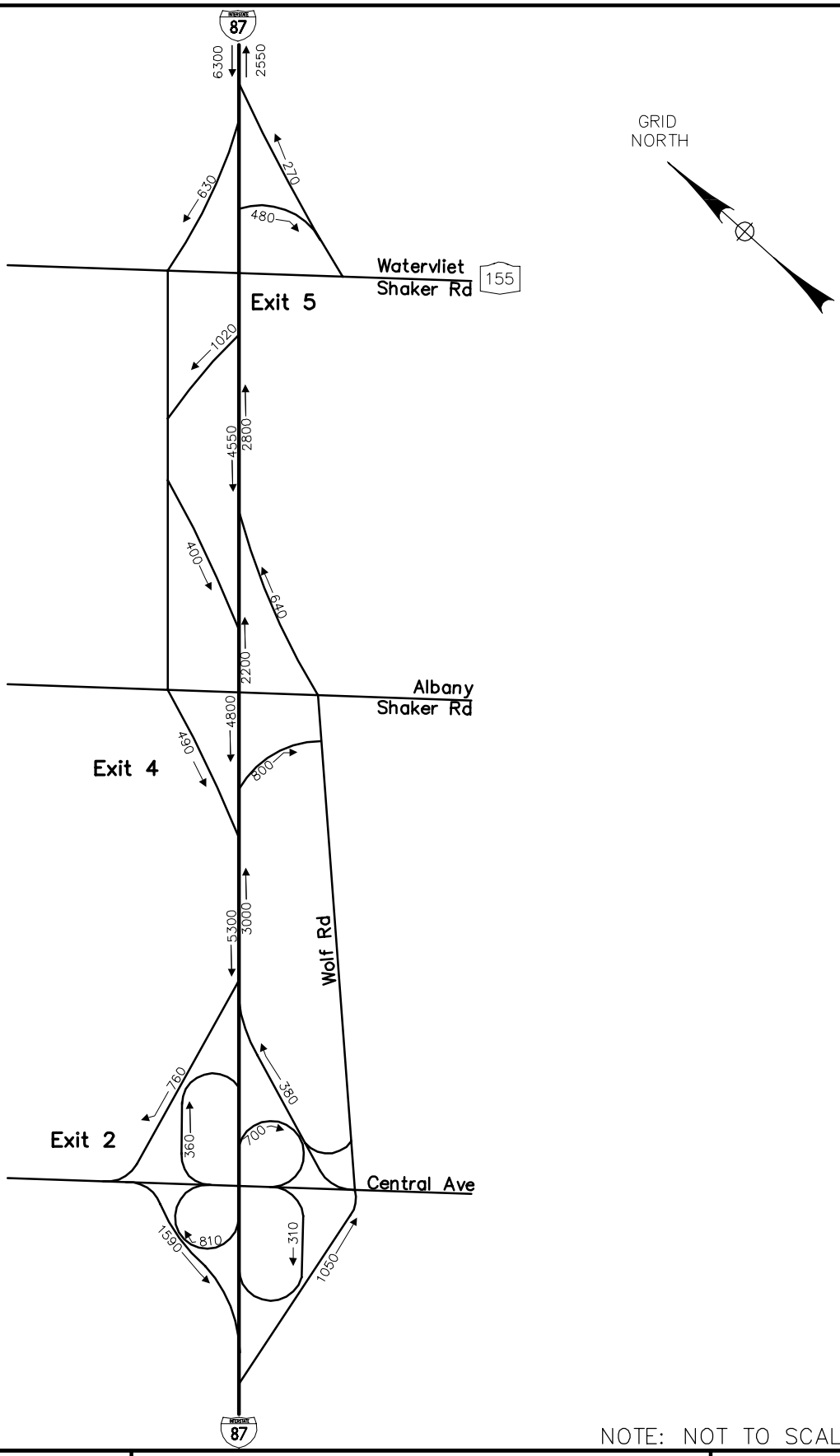

NOTE: NOT TO SCALE

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2036 NO-BUILD HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-17

DATE: 8/13

Saved: 1/9/2012 6:15:16 PM Plotted: 8/27/2013 10:58:43 AM User: Gray, Timmolyn
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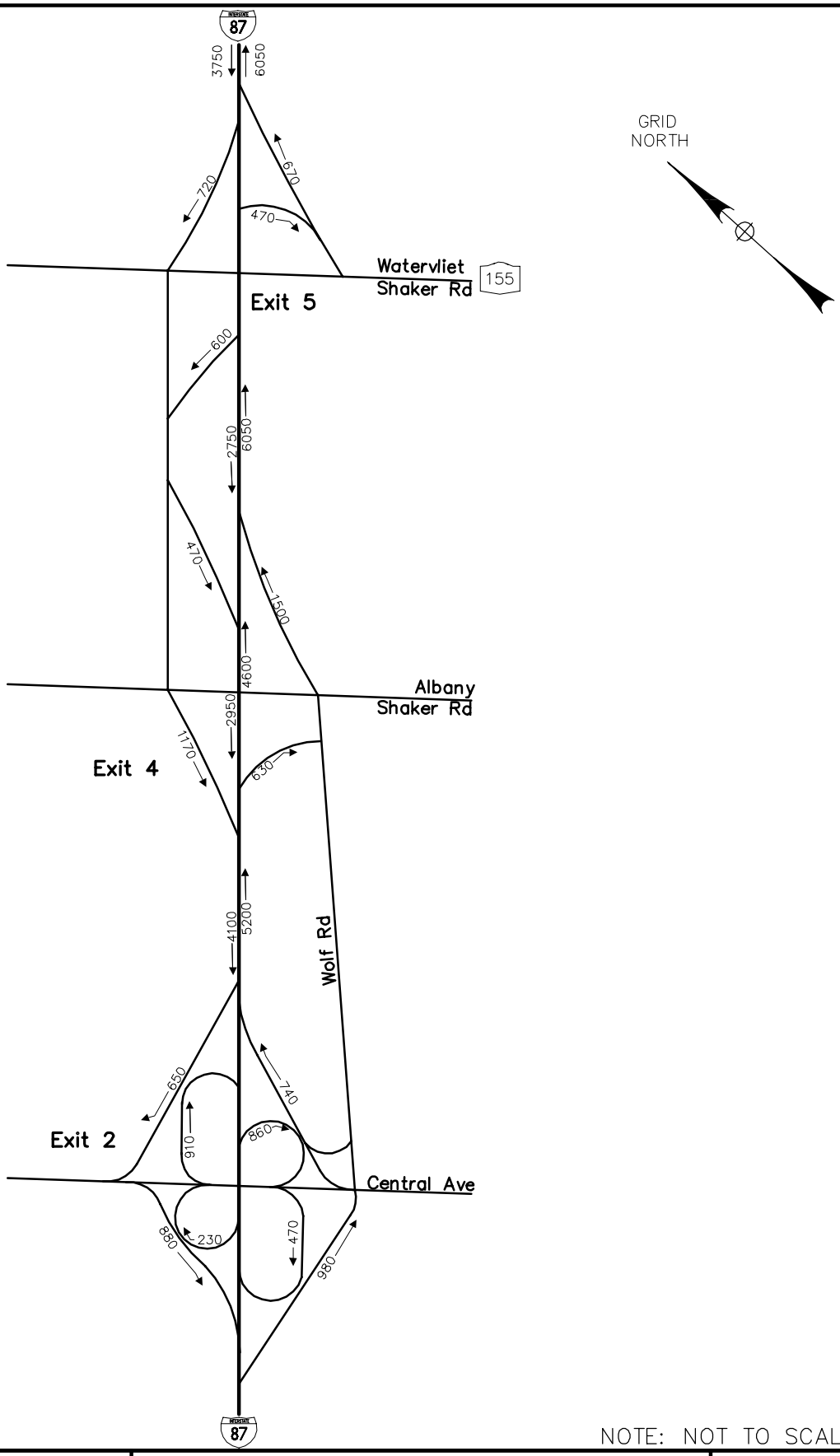

NOTE: NOT TO SCALE

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2036 NO-BUILD HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-18

DATE: 8/13

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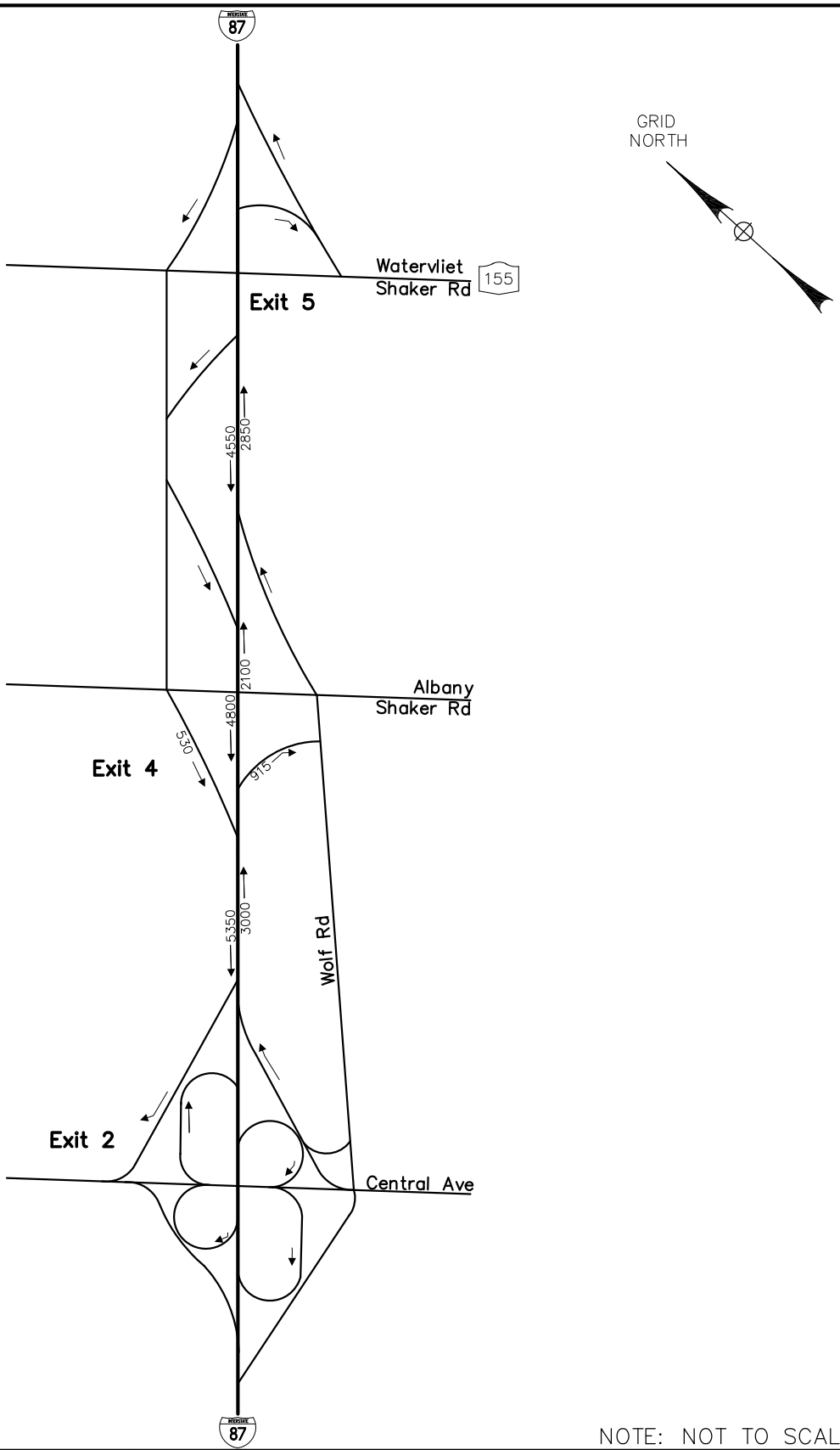

NOTE: NOT TO SCALE

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2046 NO-BUILD HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-19

DATE: 1/12

Saved: 12/21/2011 10:21:14 AM PLotted: 1/9/2012 5:07:41 PM User: Kinley, James
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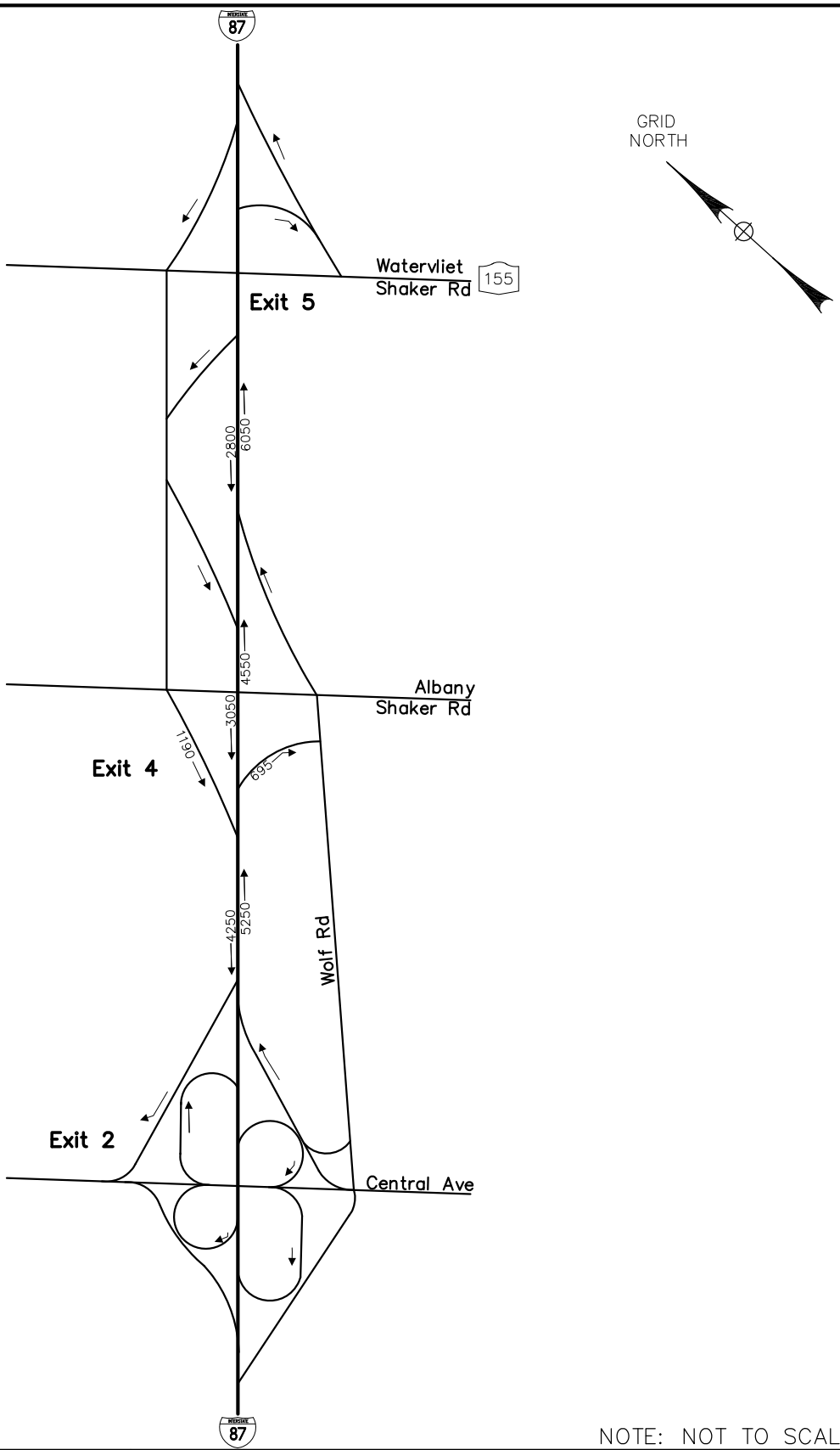

NOTE: NOT TO SCALE

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2046 NO-BUILD HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-20

DATE: 1/12

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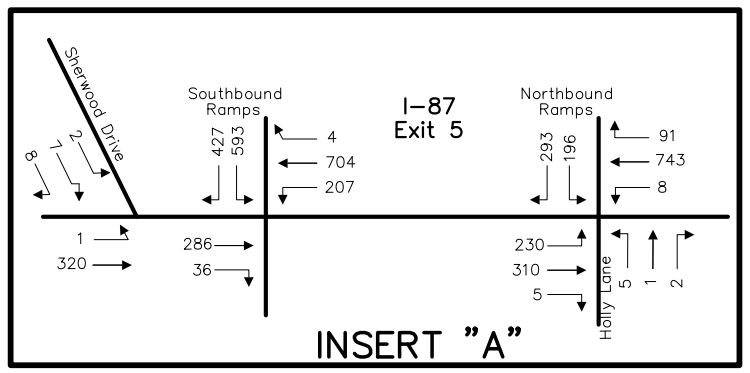

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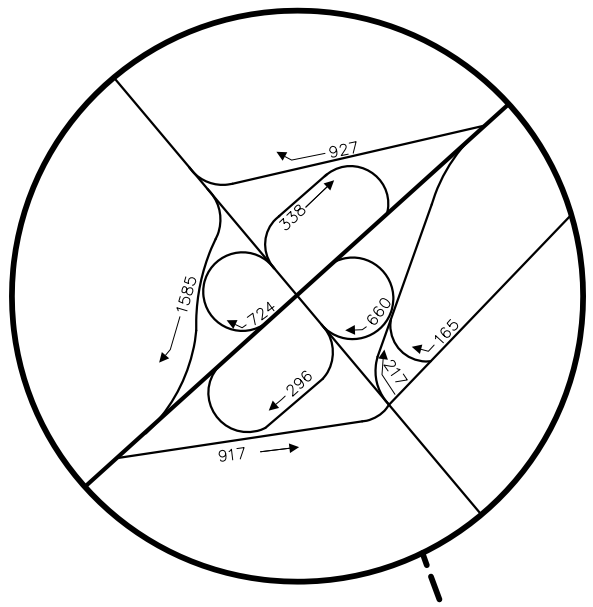

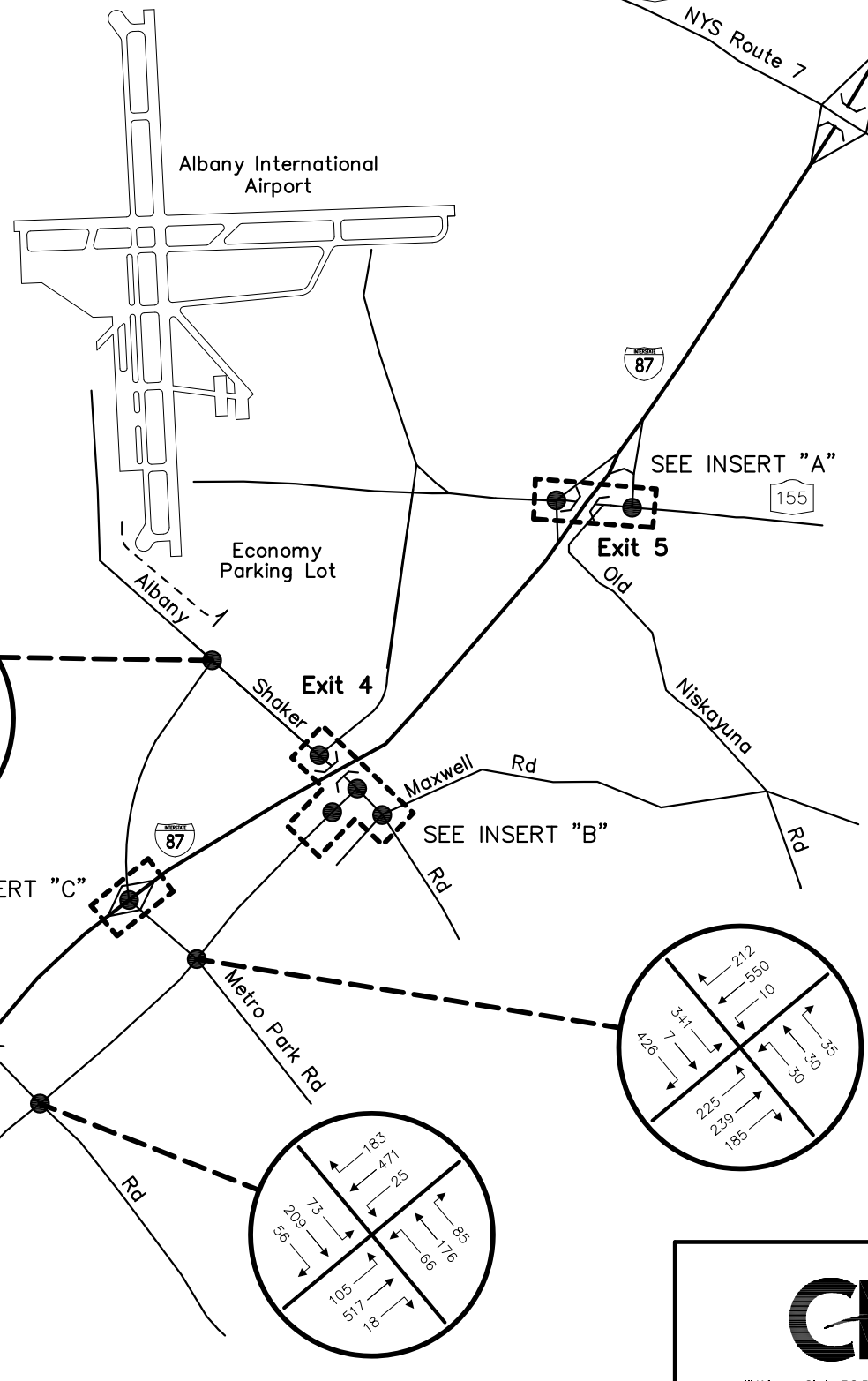

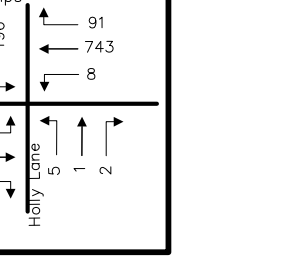

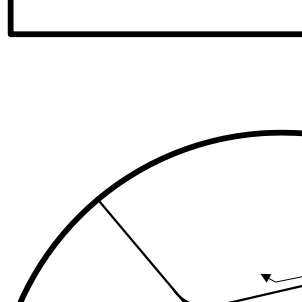

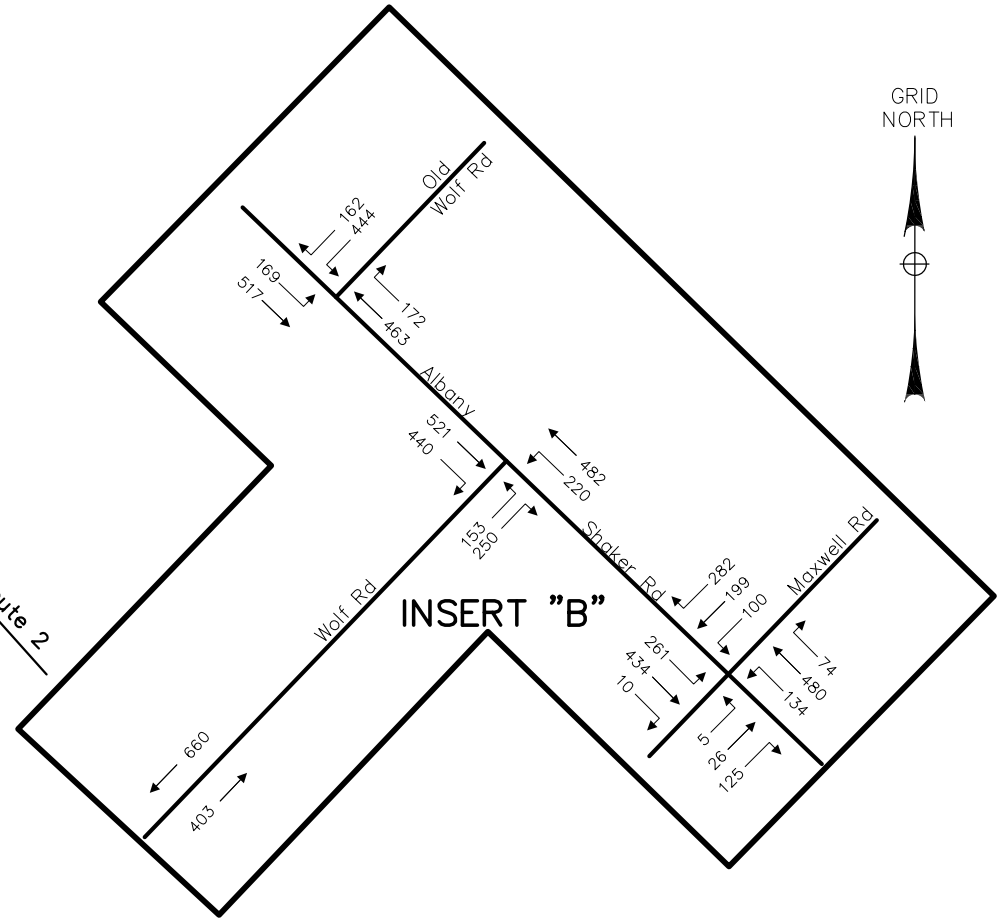

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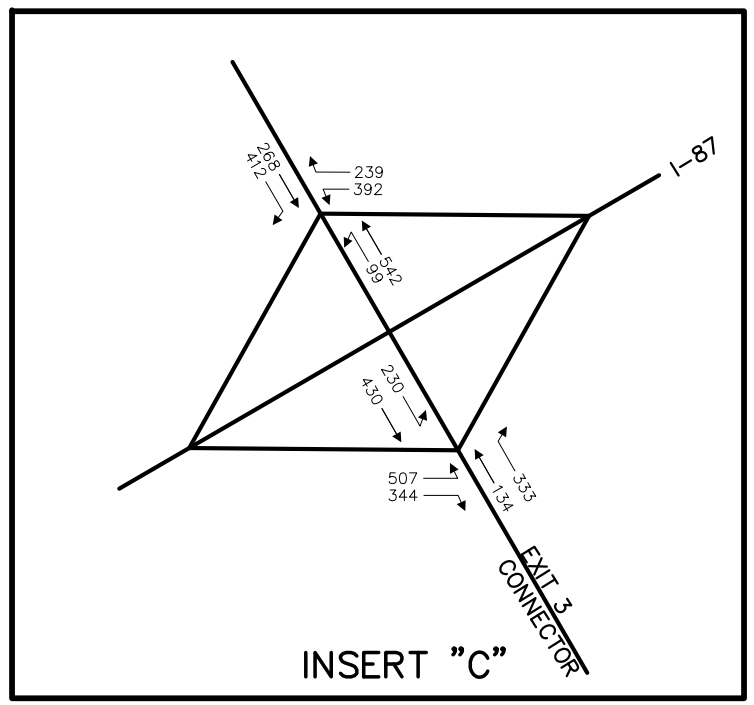

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NOTE: NOT TO SCALE

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2016 DIAMOND ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F-21
DATE:12/12

Saved: 1/9/2012 4:33:52 PM PLotted: 12/31/2012 9:25:07 AM User: Kinley, James
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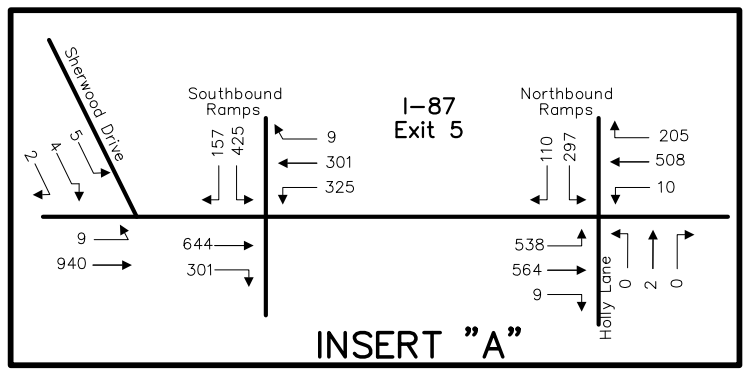

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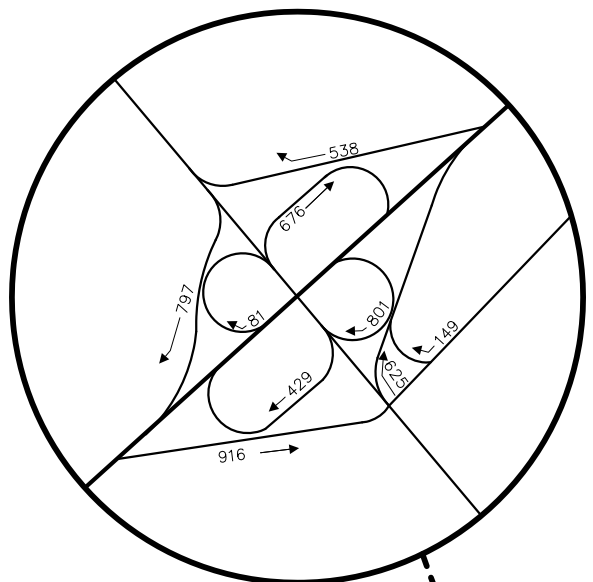

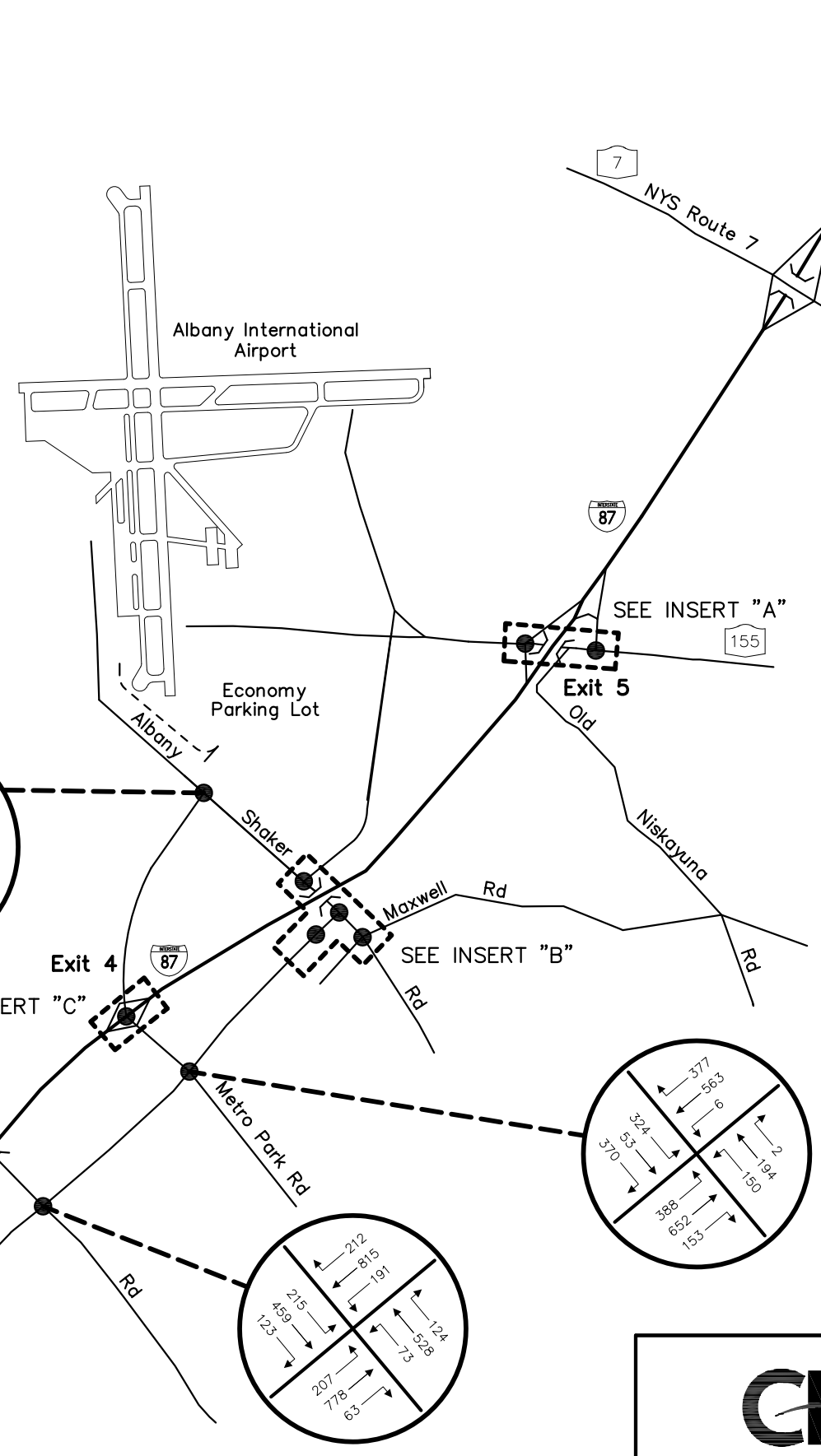

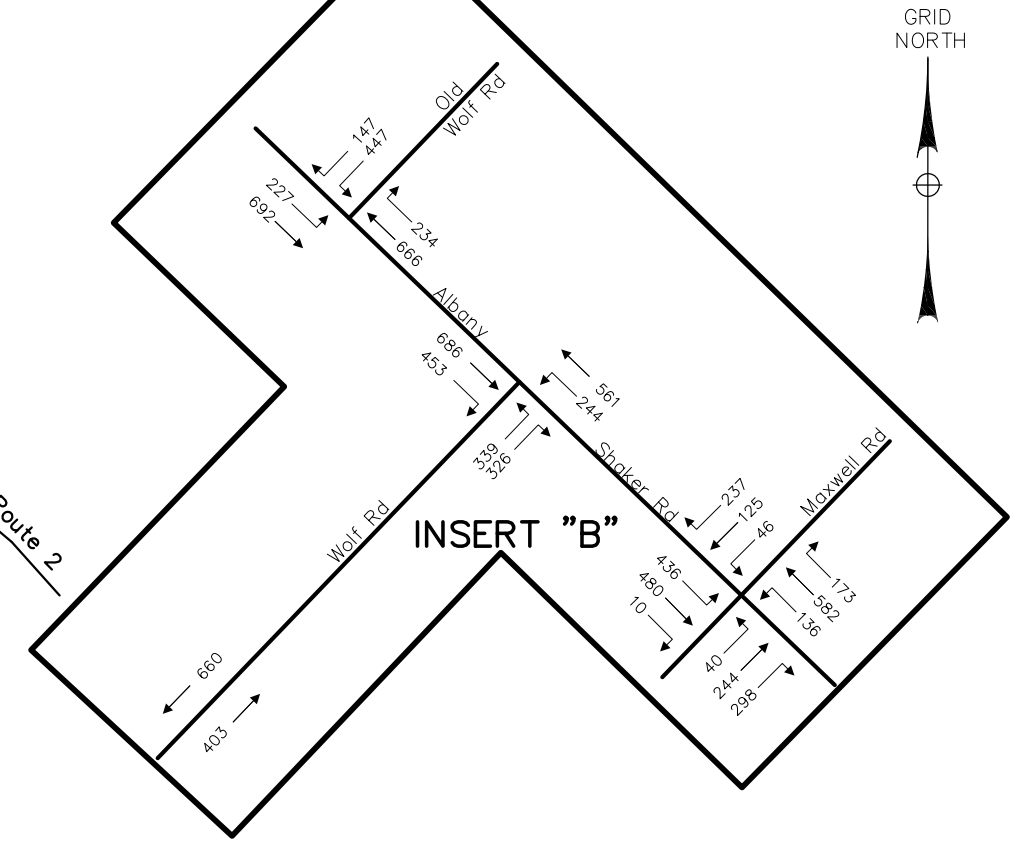

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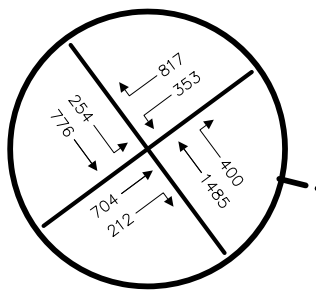

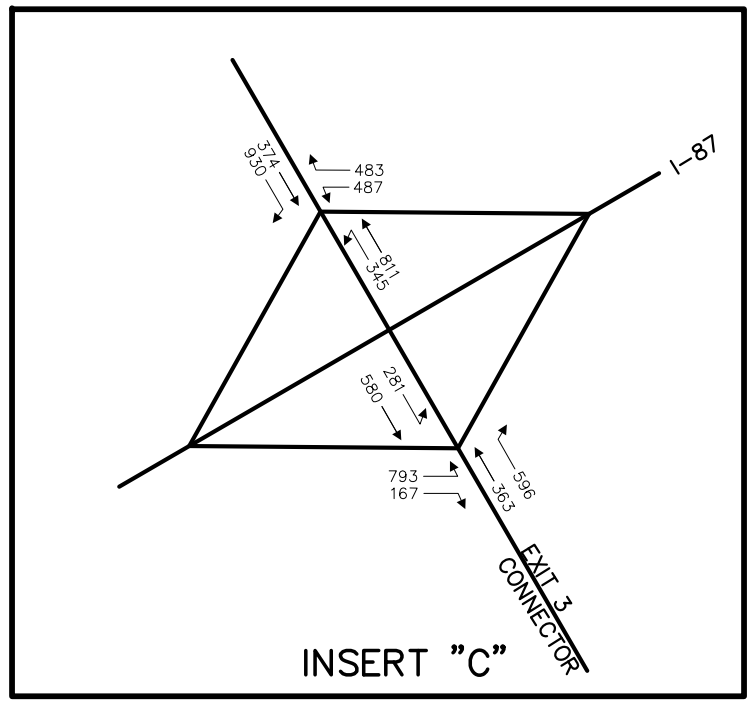

INSERT "C"

NOTE: NOT TO SCALE

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2016 DIAMOND ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

FIGURE F-22

DATE:12/12

Saved: 1/9/2012 4:16:58 PM PLotted: 12/31/2012 9:26:22 AM User: Kinley, James
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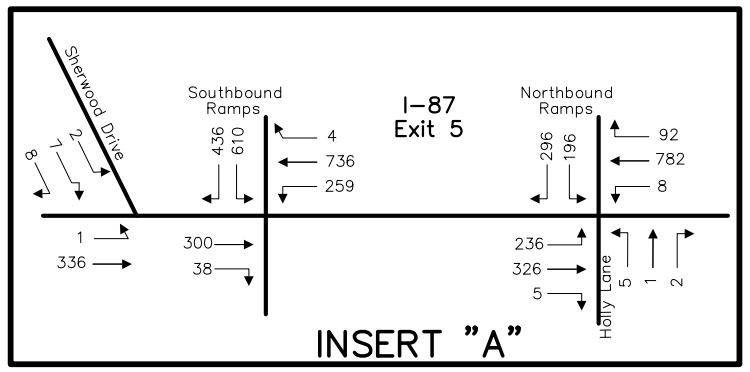

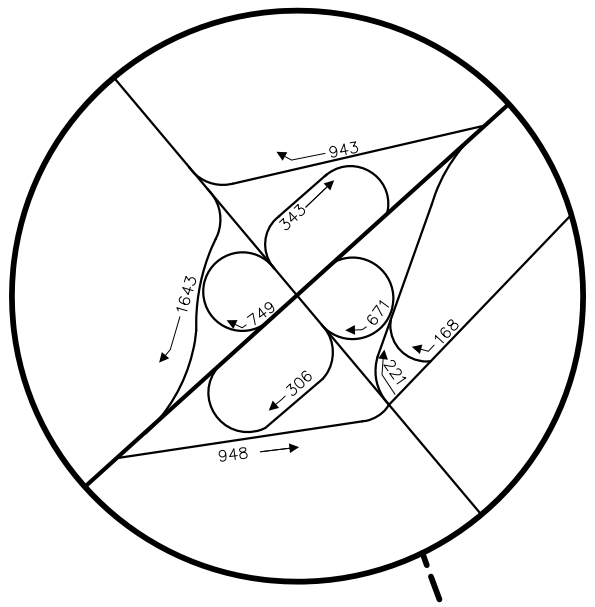

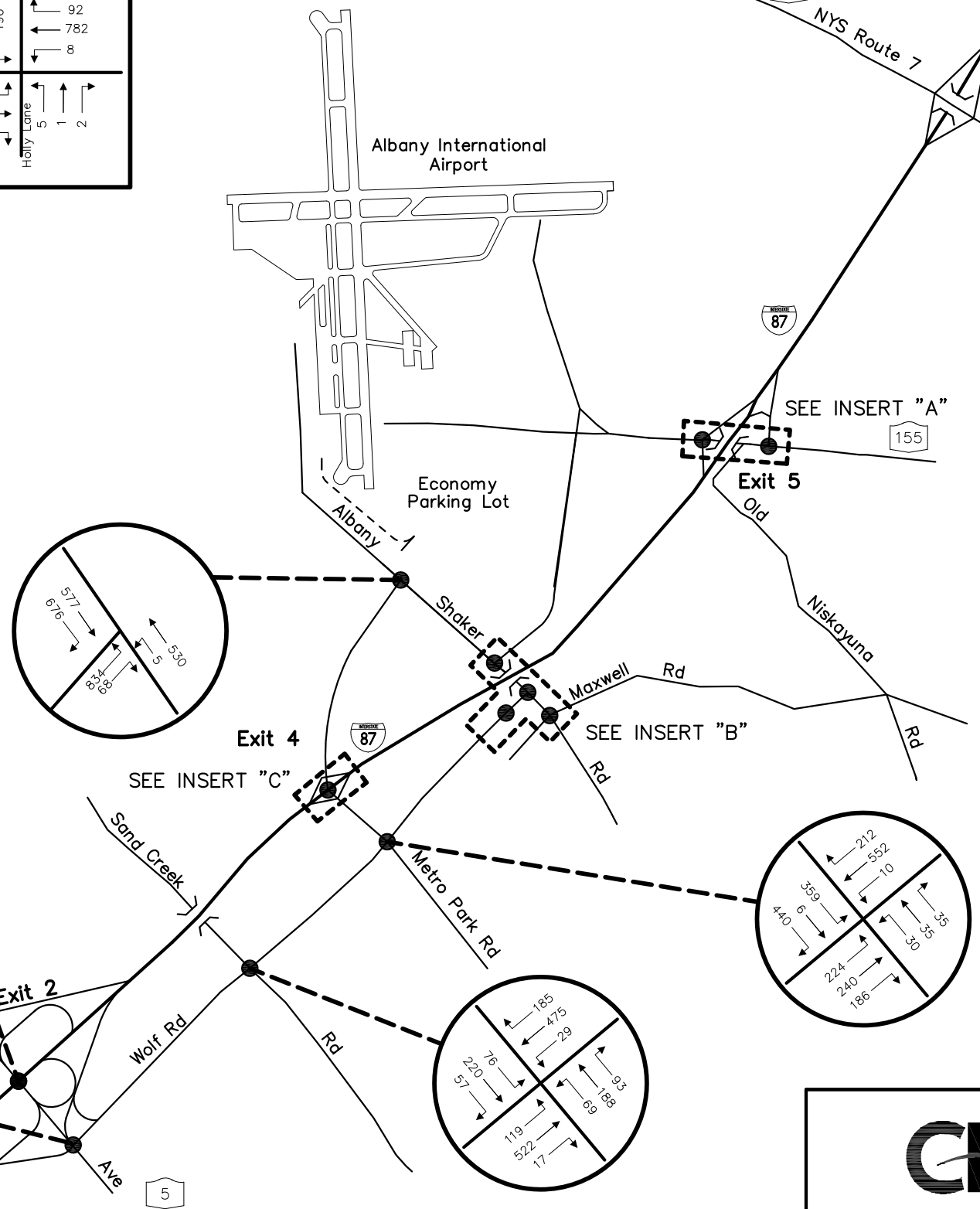

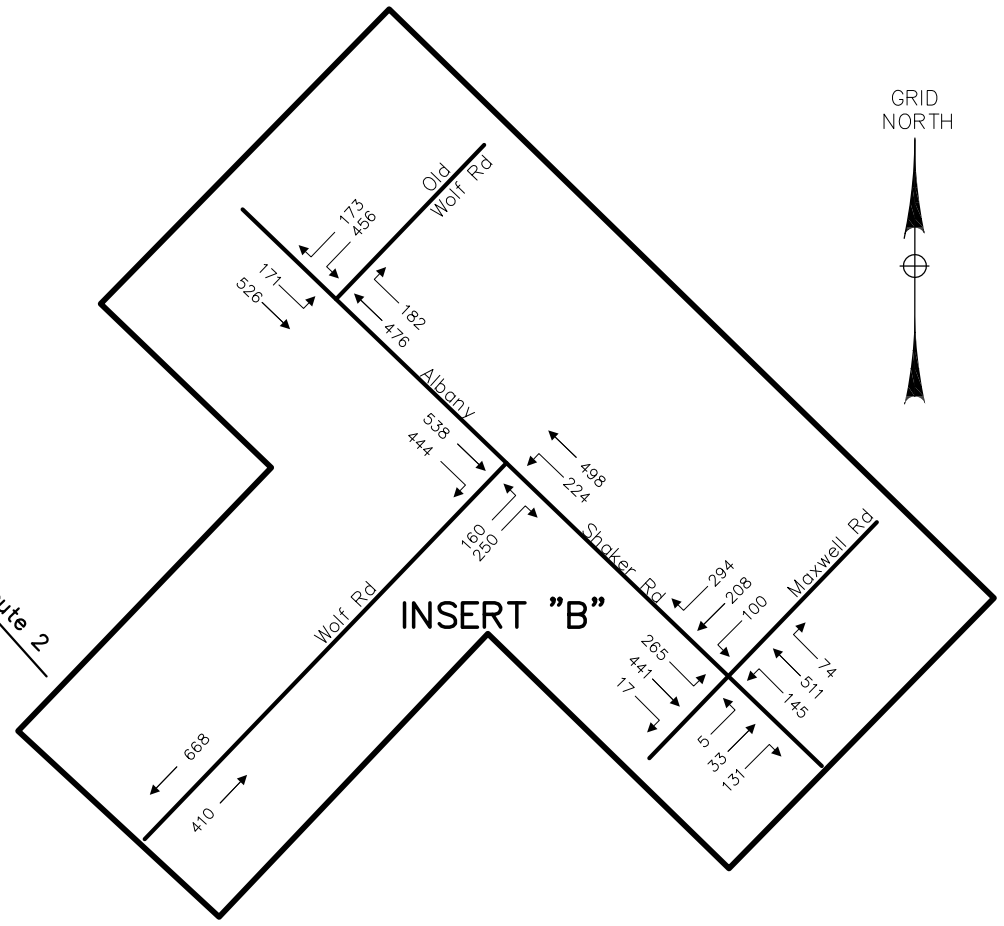

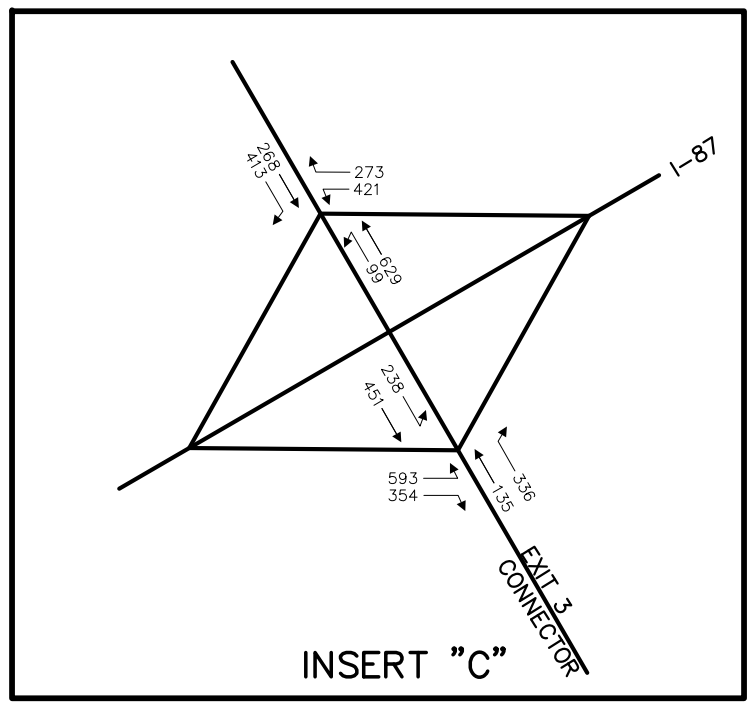

NOTE: NOT TO SCALE

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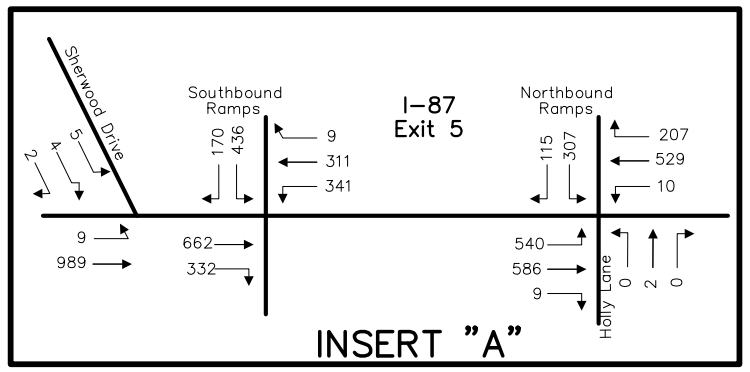
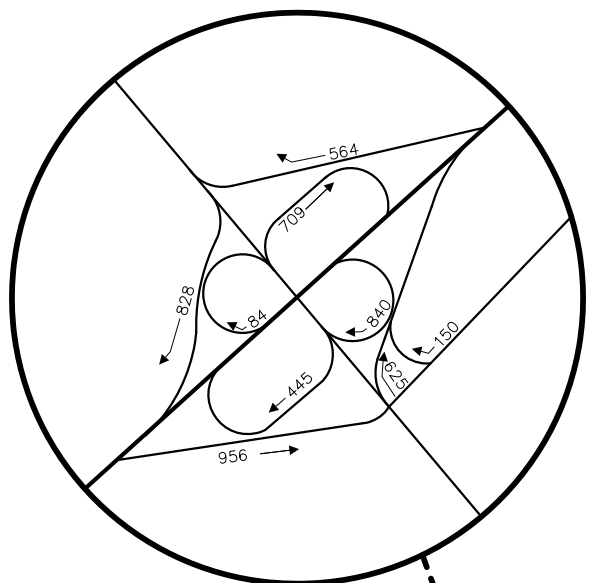
2026 DIAMOND ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

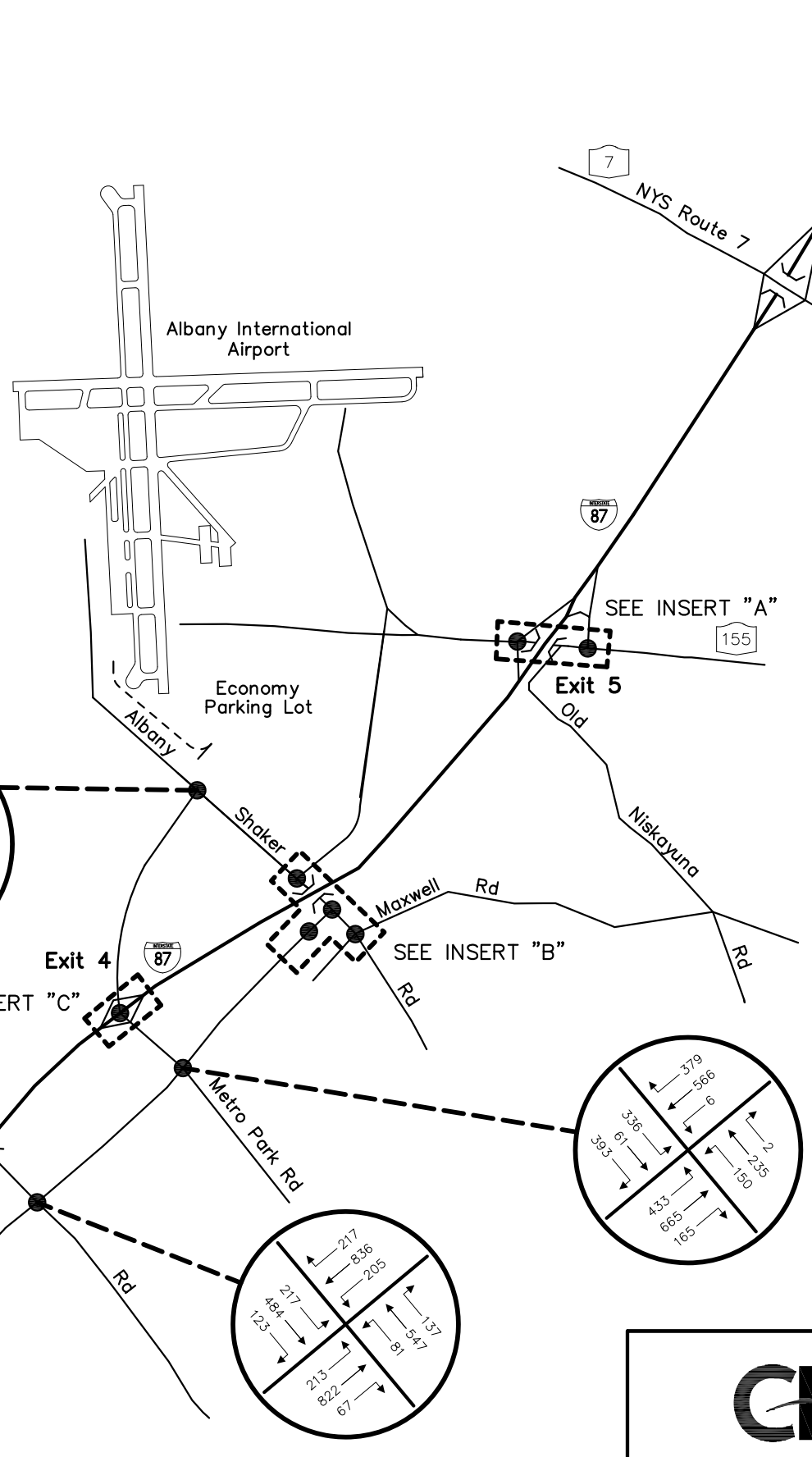
INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

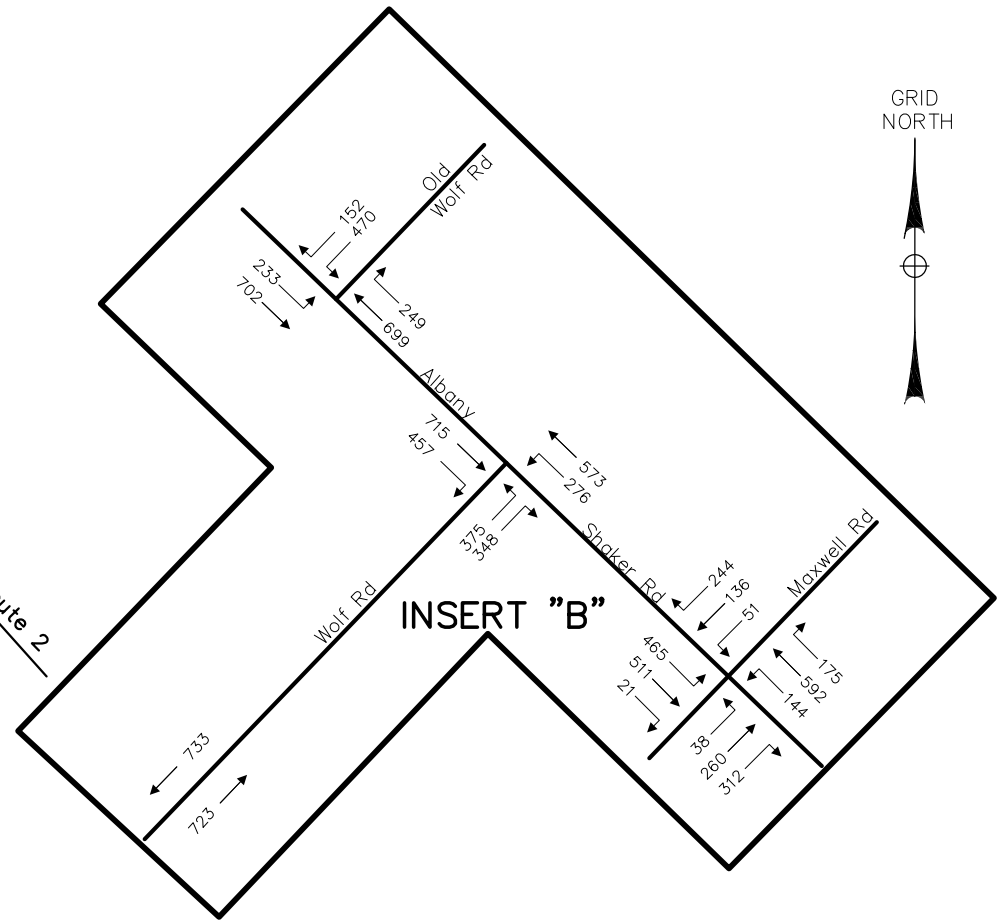
FIGURE
F-23
DATE:12/12

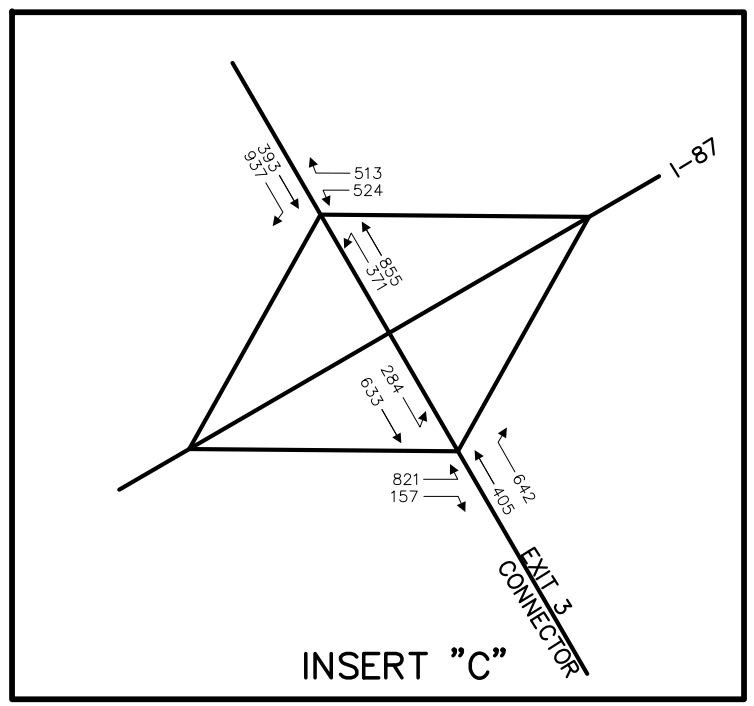
Saved: 1/9/2012 4:16:37 PM PLotted: 12/31/2012 9:30:19 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2026 AM DIAMOND.DWG











NOTE: NOT TO SCALE

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2026 DIAMOND ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F-24

DATE:12/12

Saved: 1/9/2012 5:16:15 PM PLotted: 12/31/2012 9:32:55 AM User: Kinley, James
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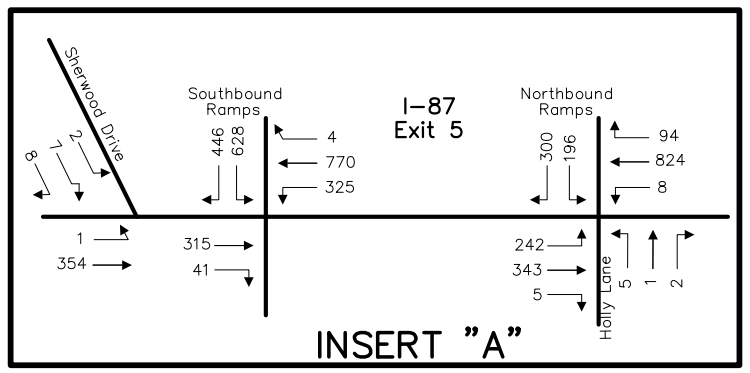

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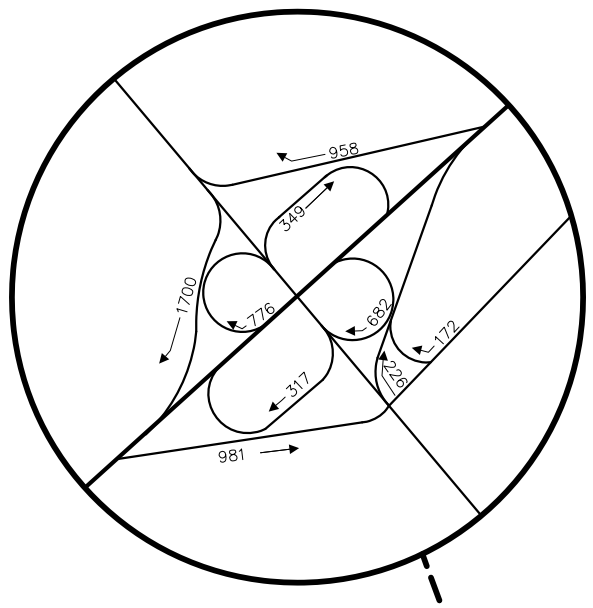

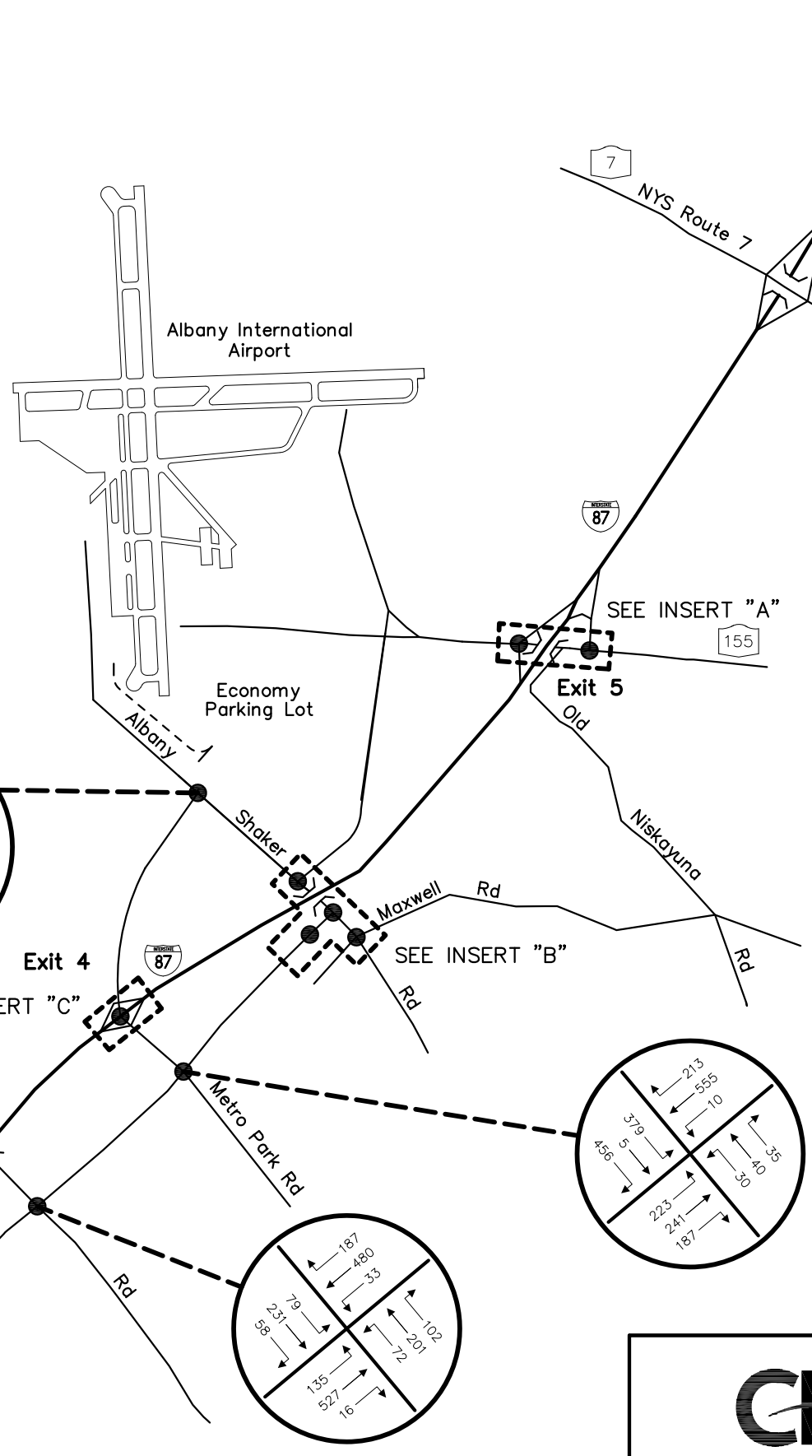

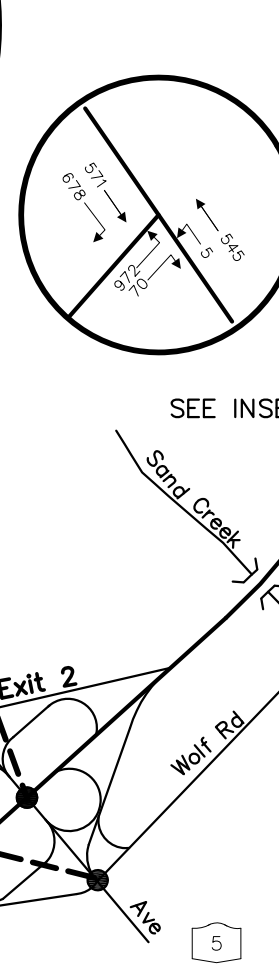

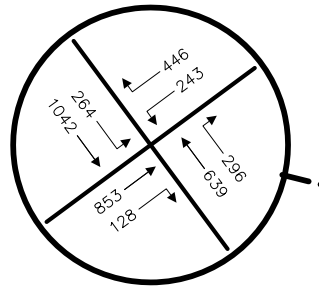

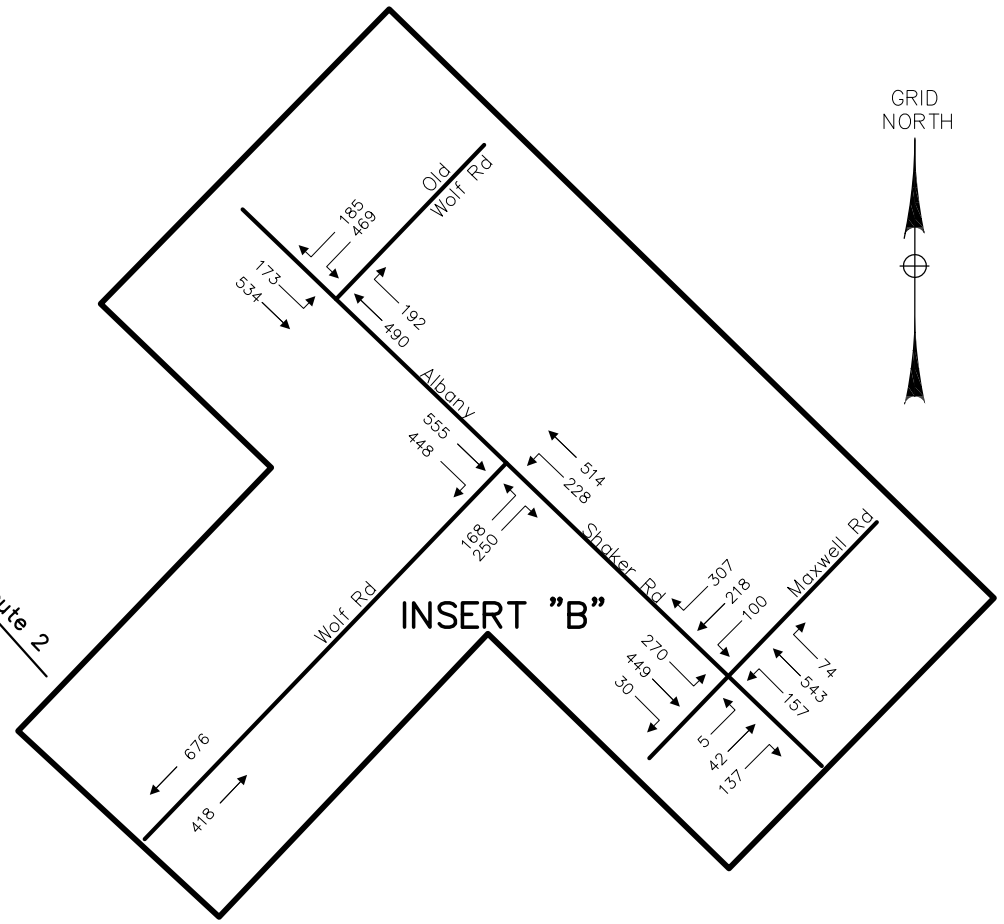

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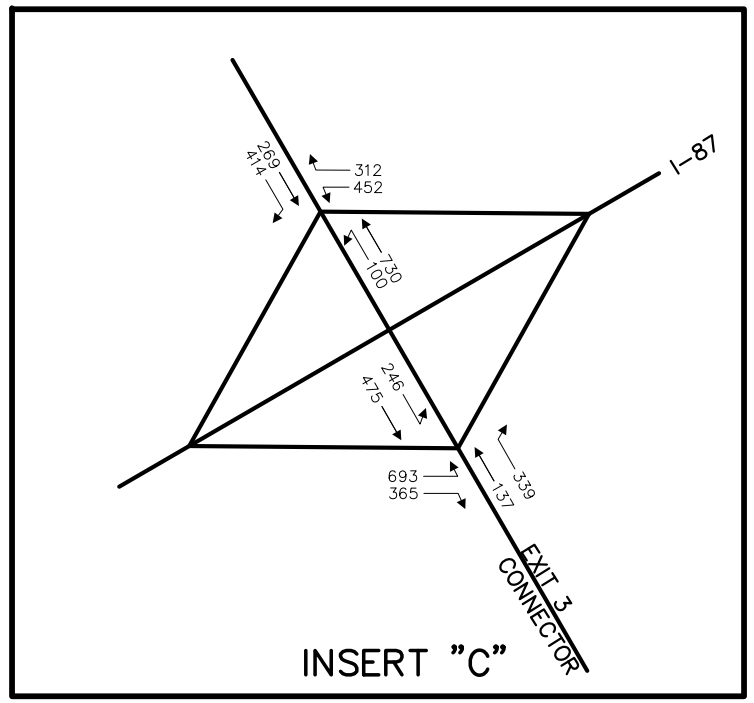

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2036 DIAMOND ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

FIGURE F-25

DATE:12/12

Saved: 1/9/2012 5:15:50 PM PLotted: 12/31/2012 9:35:00 AM User: Kinley, James
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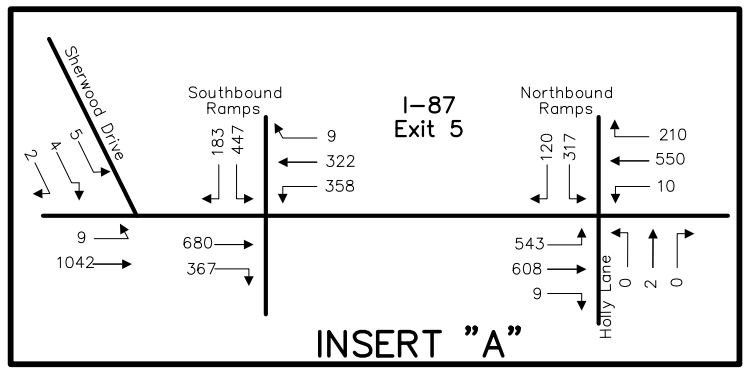

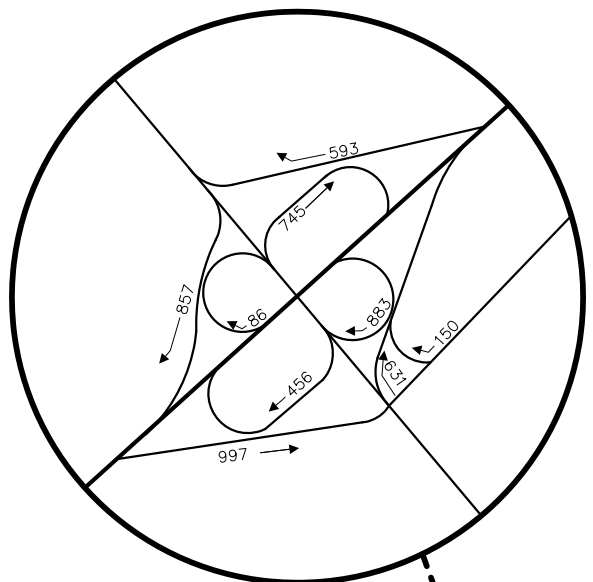

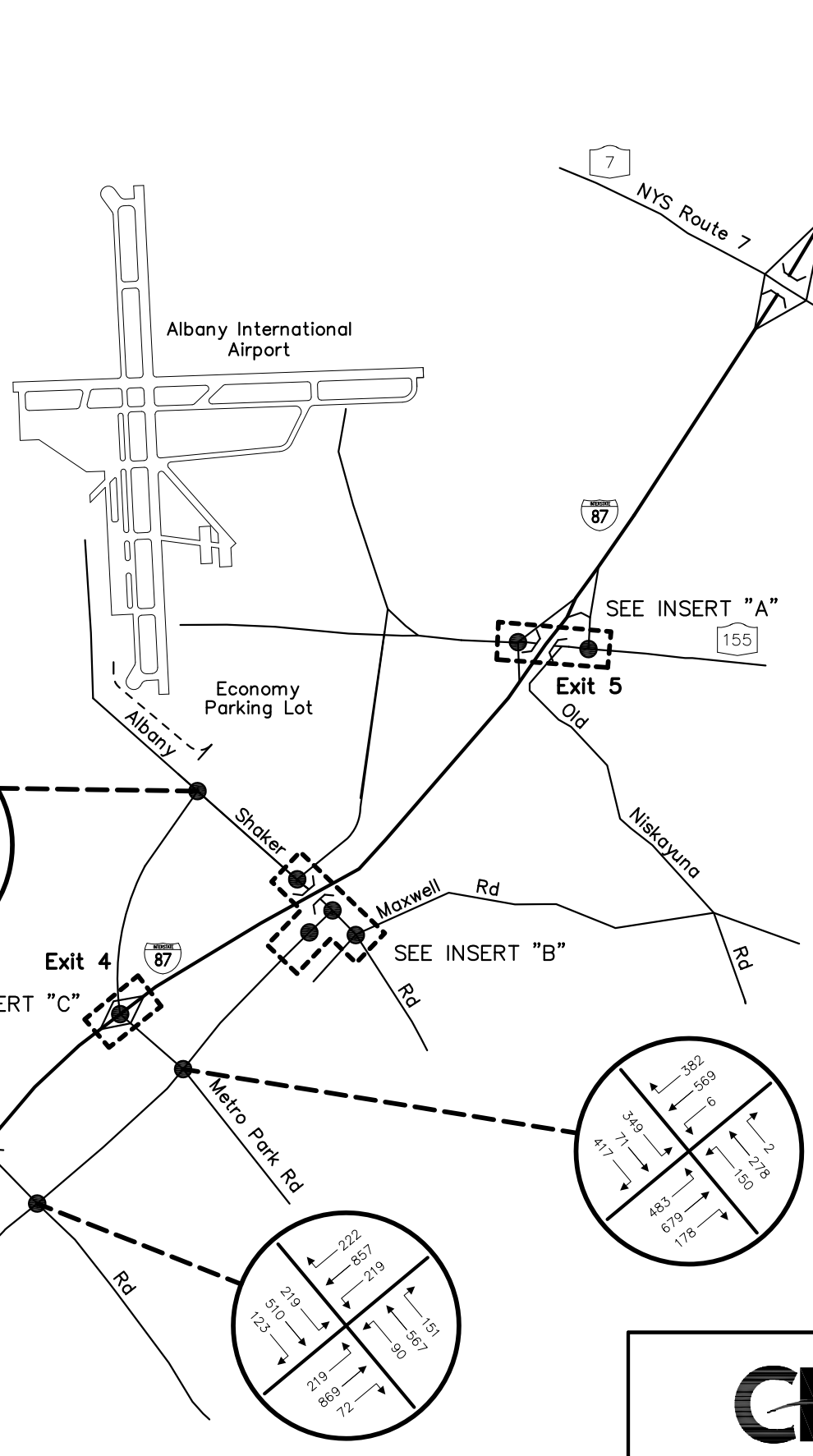

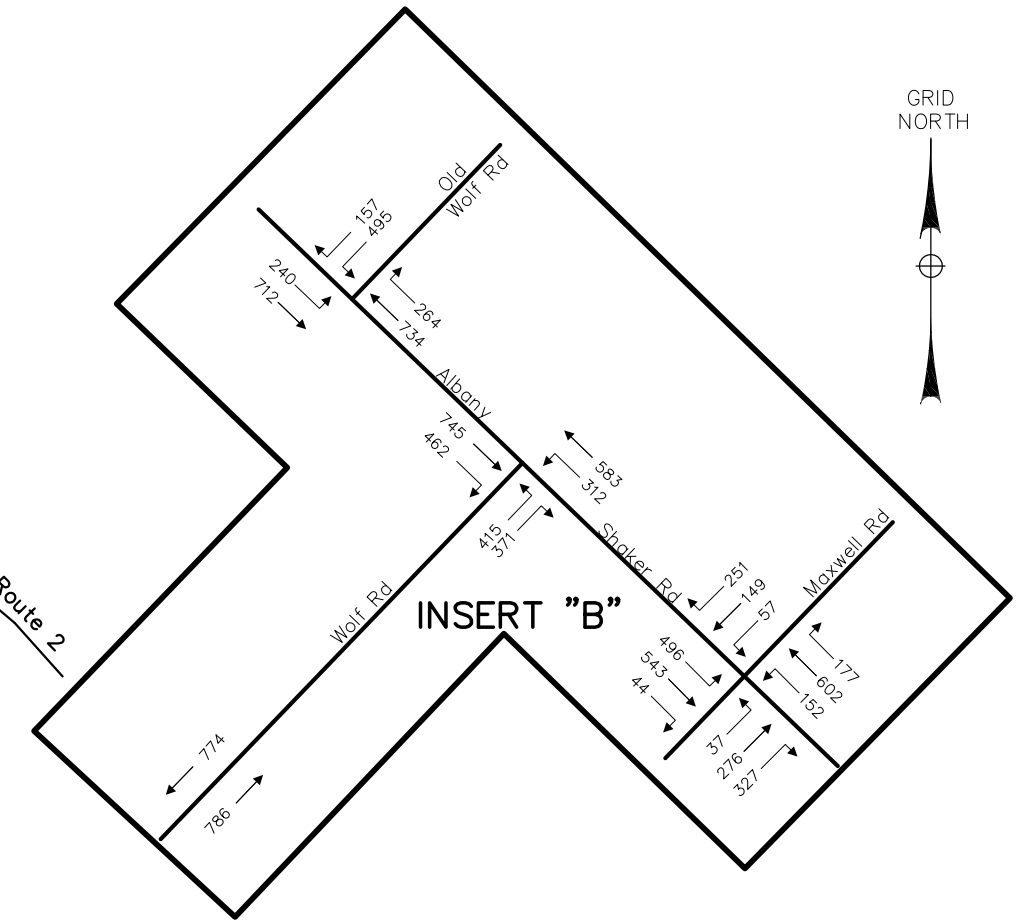

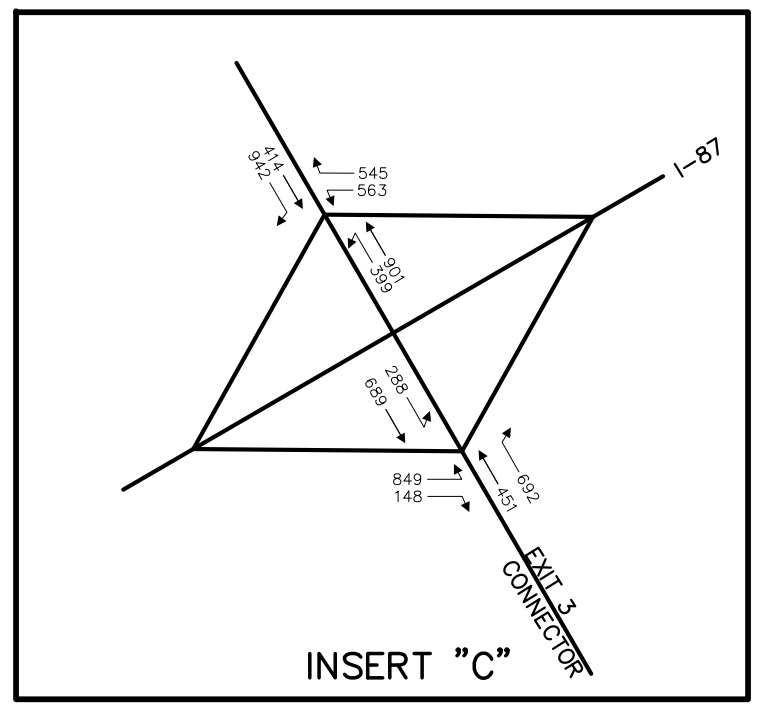

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2036 DIAMOND ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F-26

DATE:12/12

Saved: 1/9/2012 5:15:12 PM PLotted: 12/31/2012 9:36:18 AM User: Kinley, James
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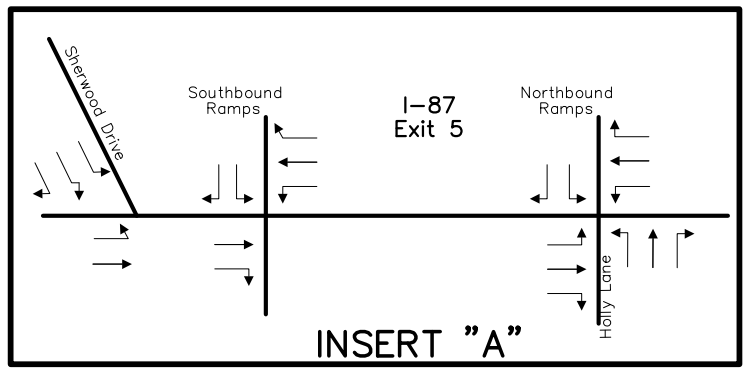

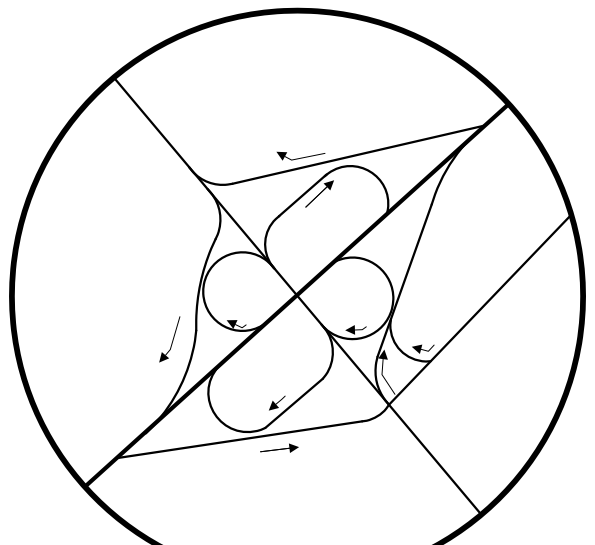

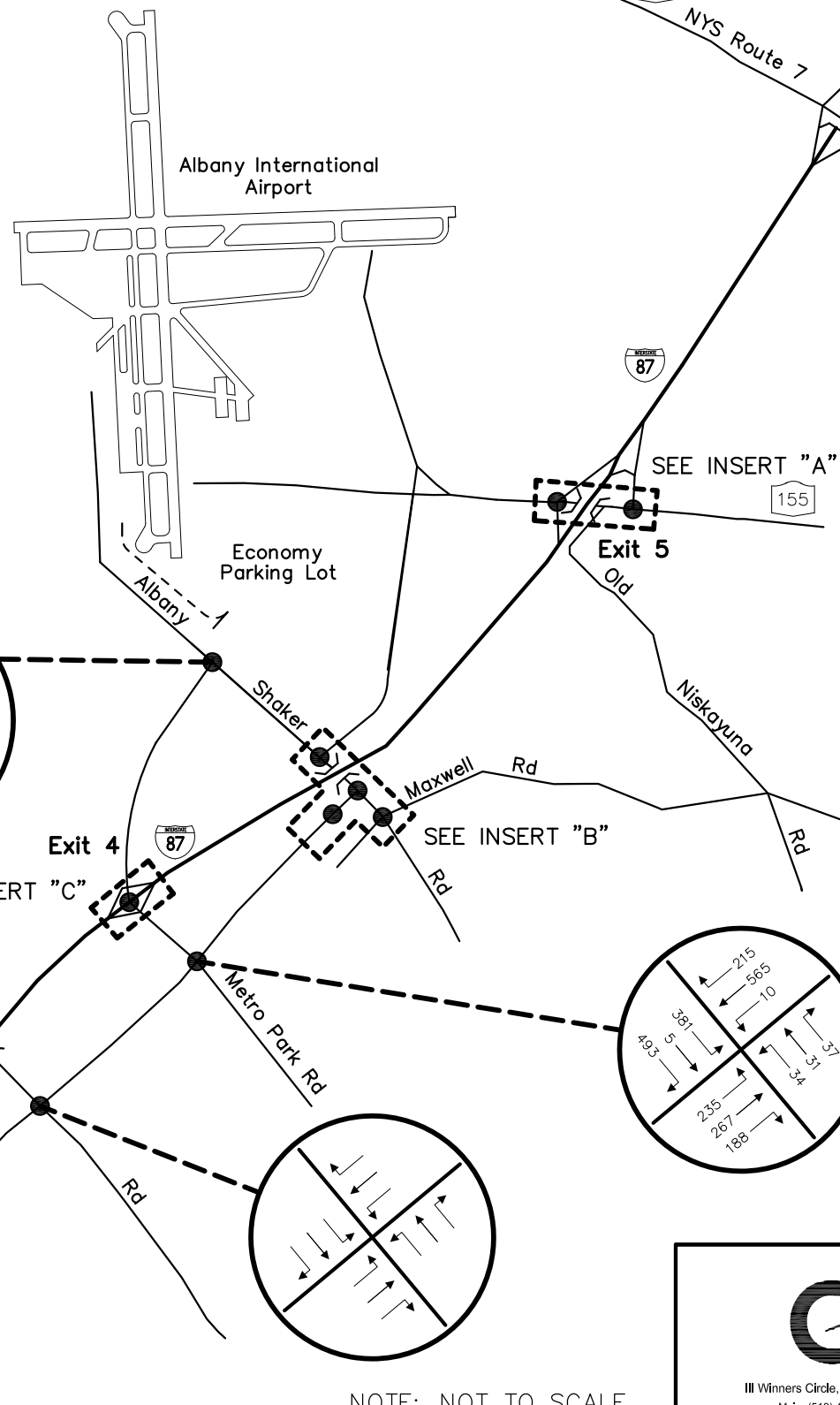

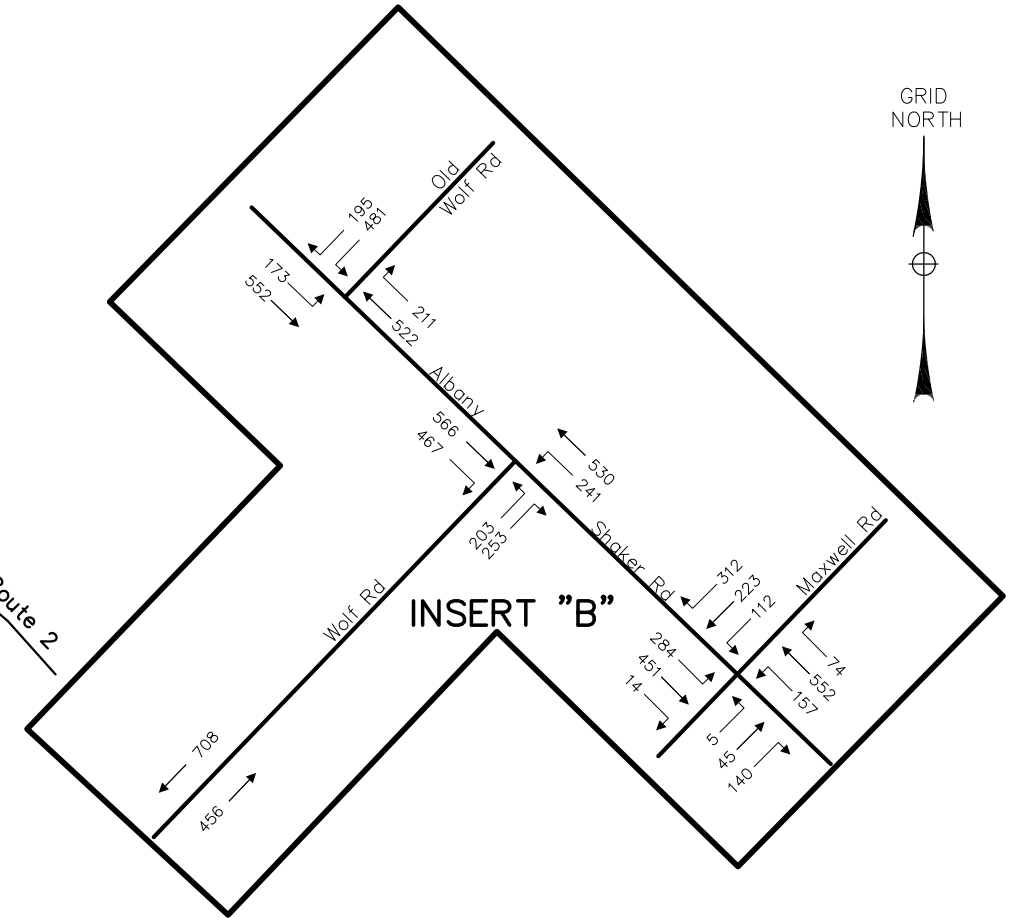

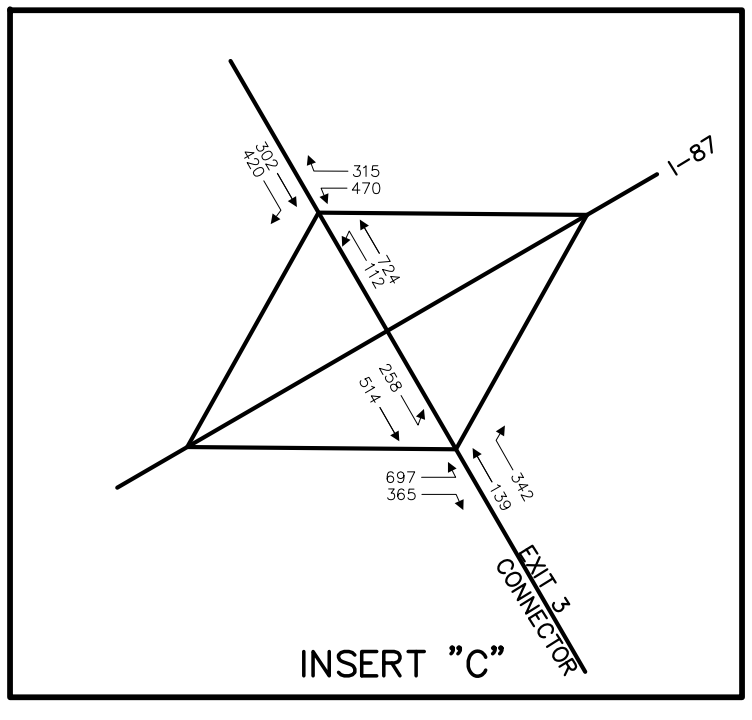

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2046 DIAMOND ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F-27

DATE:12/12

Saved: 1/9/2012 5:15:00 PM PLotted: 12/31/2012 9:38:50 AM User: Kinley, James
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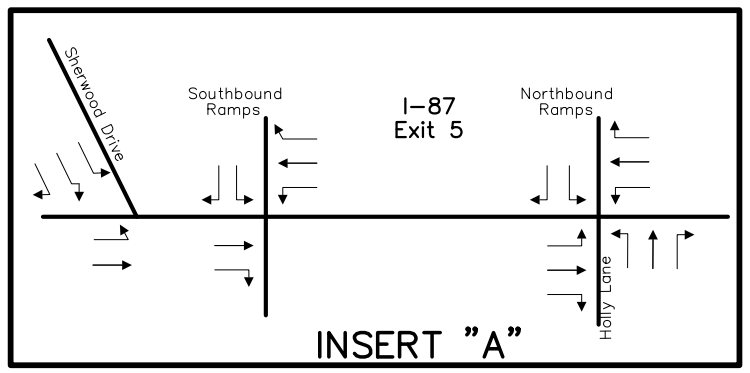

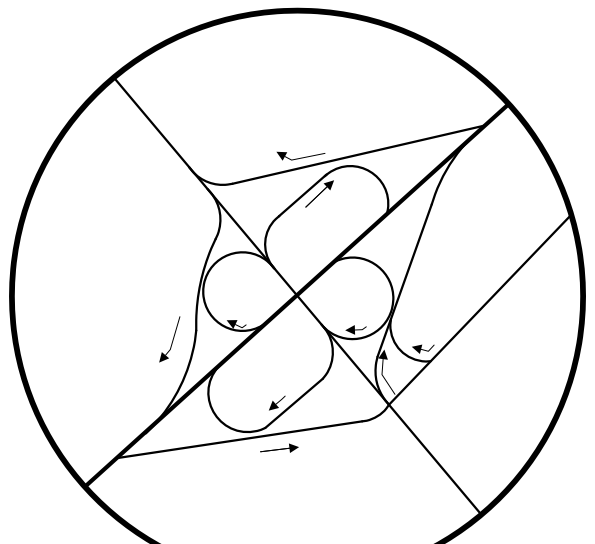

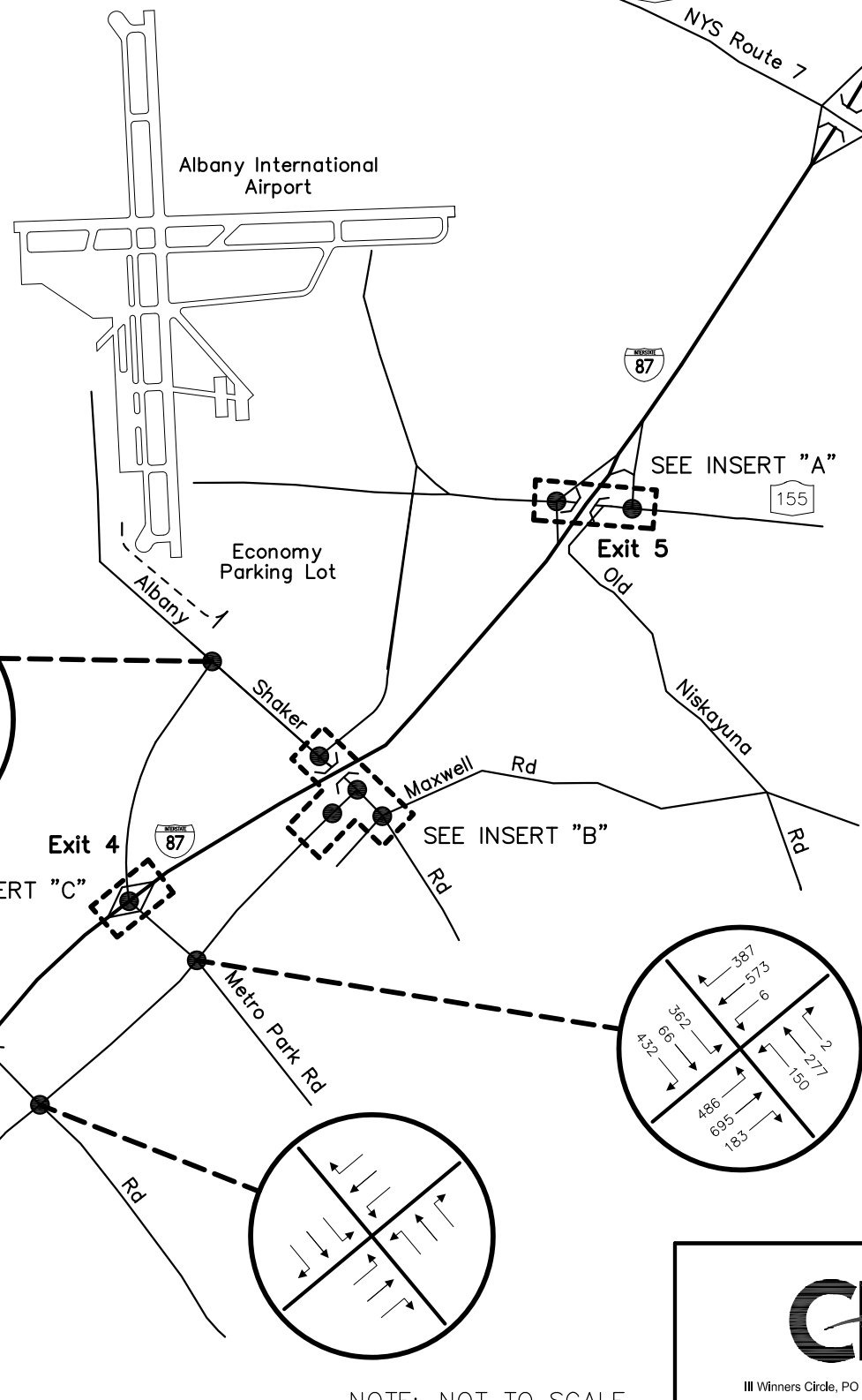

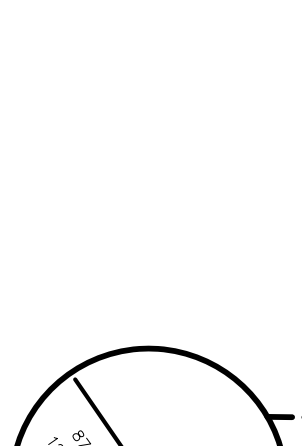

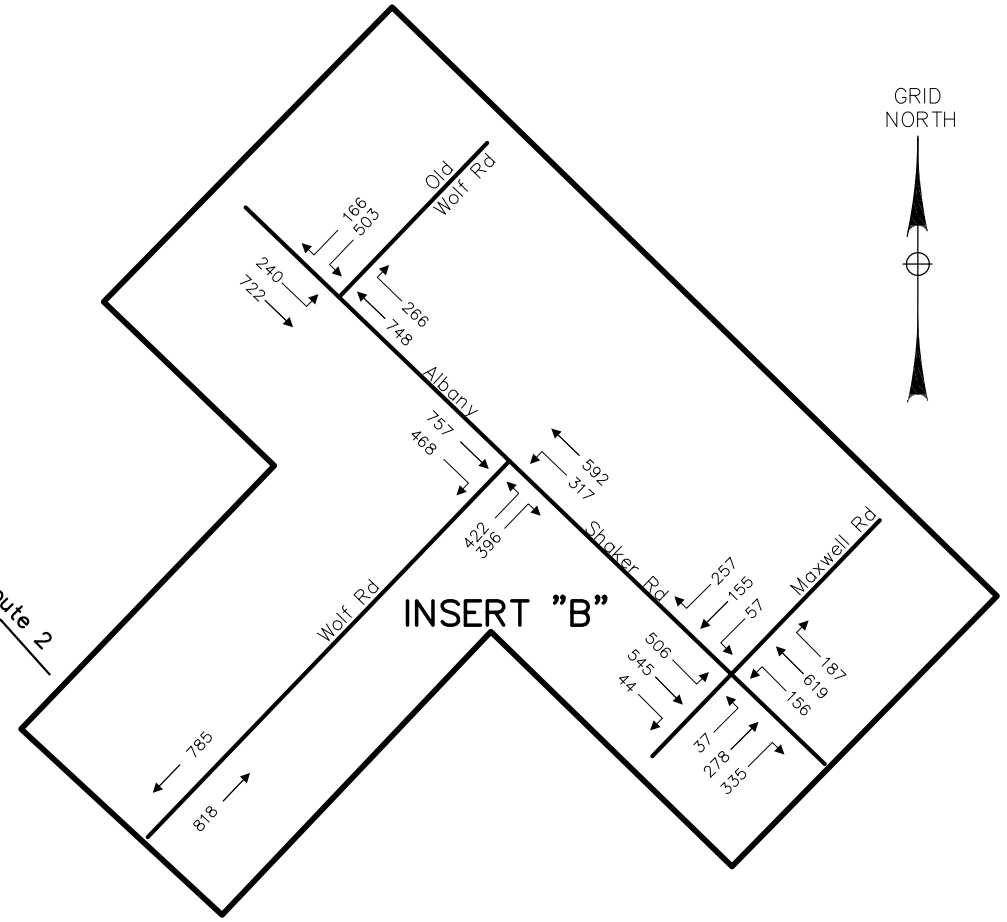

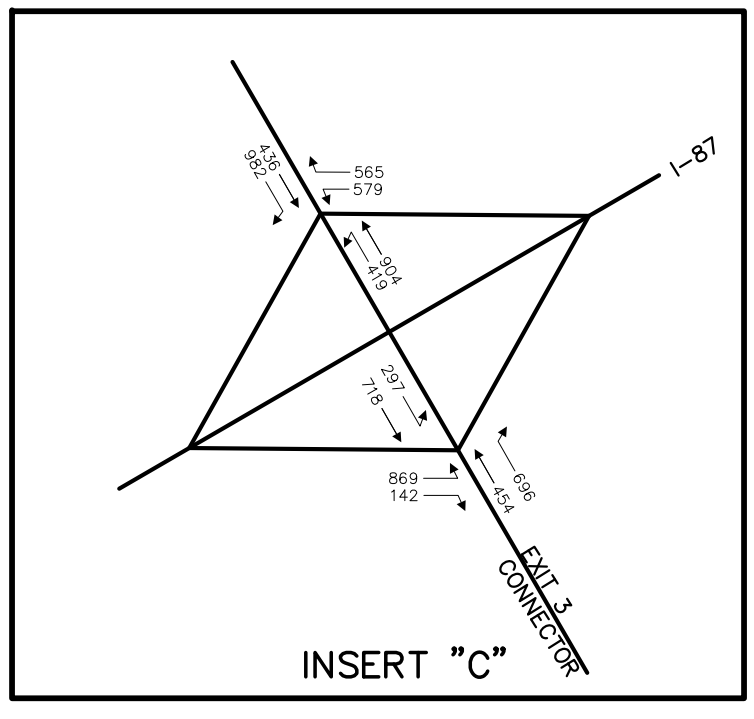

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2046 DIAMOND ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F-28
DATE:12/12

NOTE: NOT TO SCALE

Saved: 1/9/2012 5:14:32 PM PLotted: 12/31/2012 9:39:52 AM User: Kinley, James
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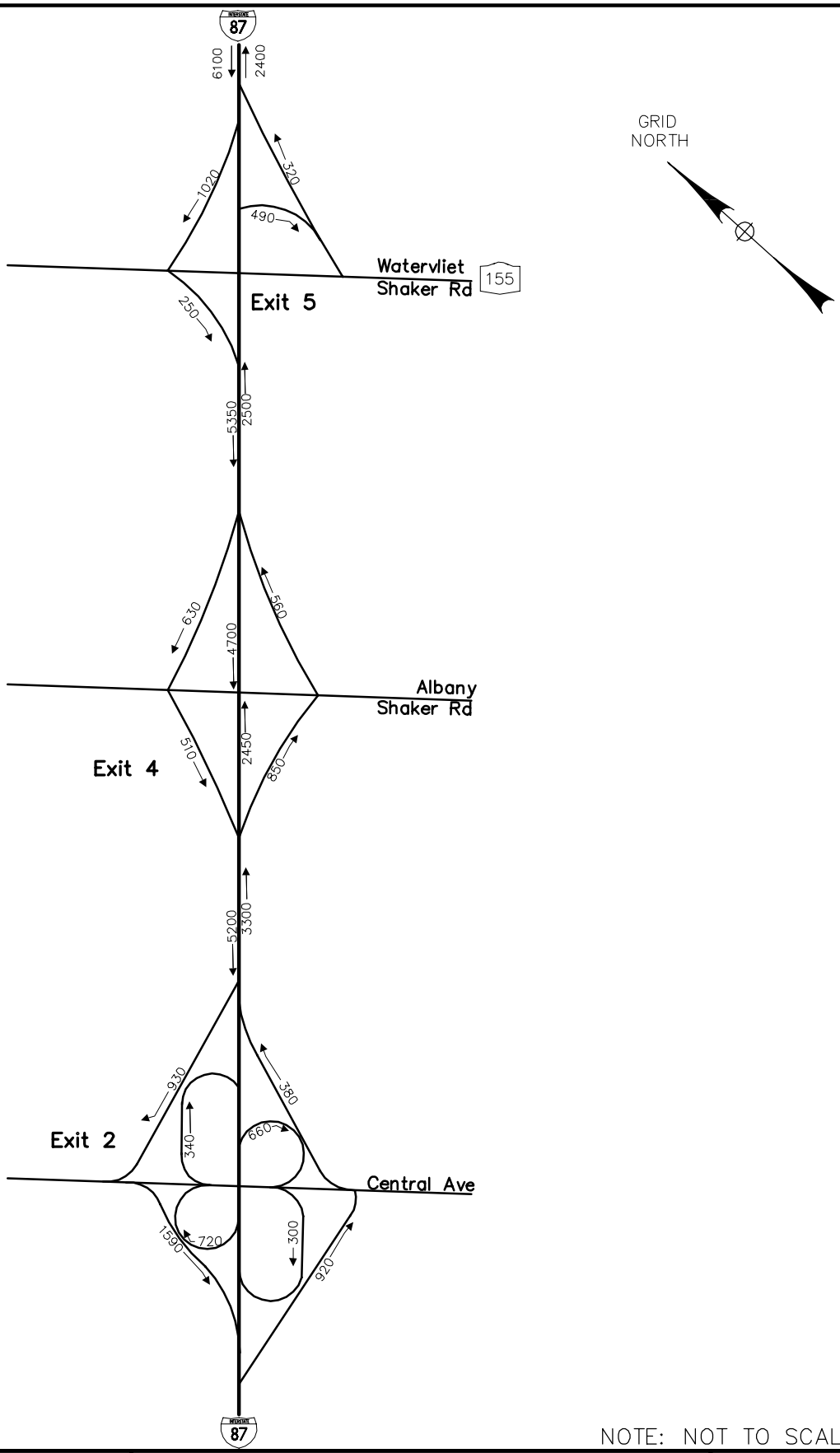

NOTE: NOT TO SCALE

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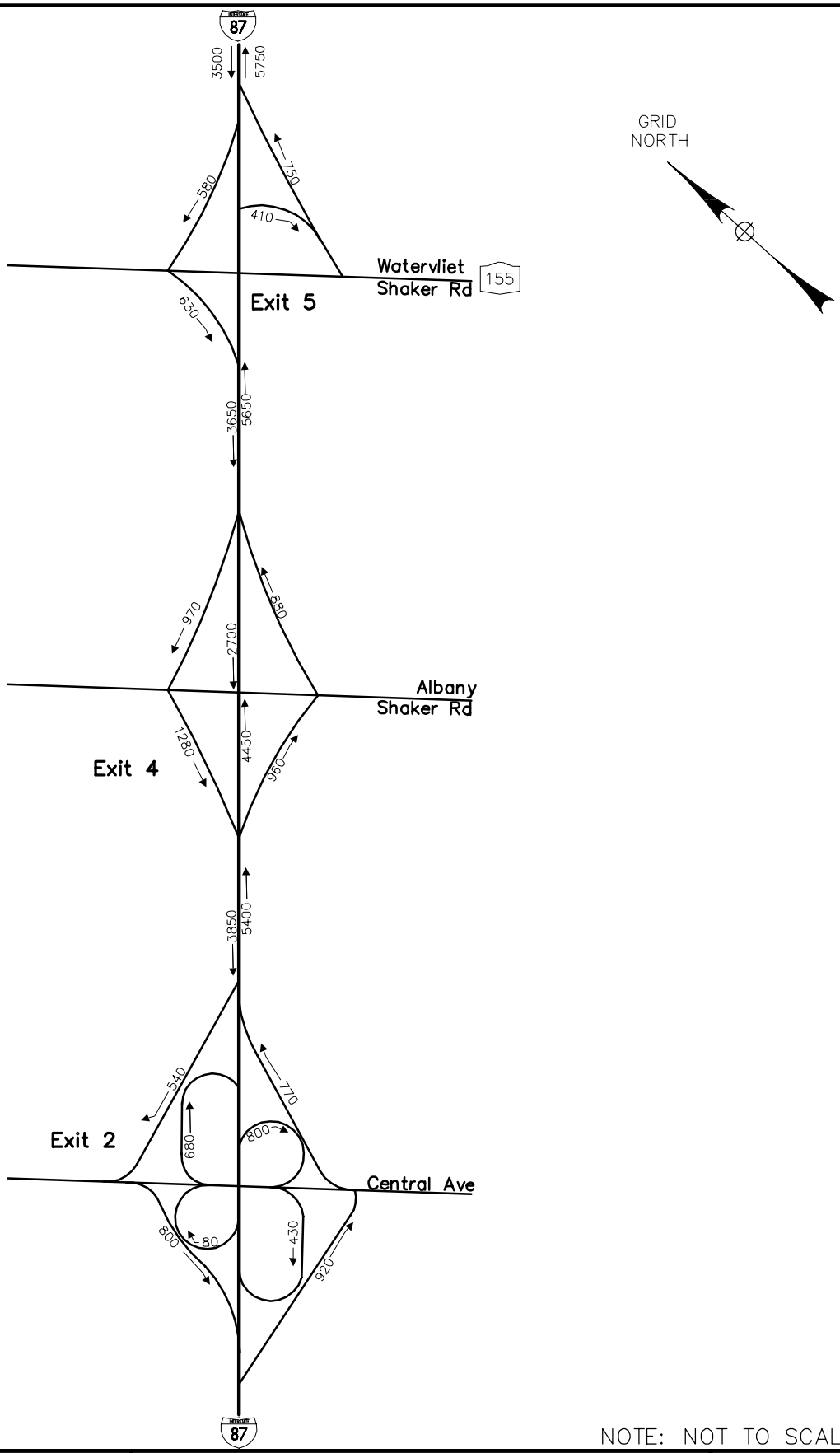
2016 DIAMOND ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-29

DATE: 8/13

Saved: 12/31/2012 11:06:26 AM PLotted: 8/27/2013 11:01:38 AM User: Gray, Timmalyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2016 AM DIAMOND HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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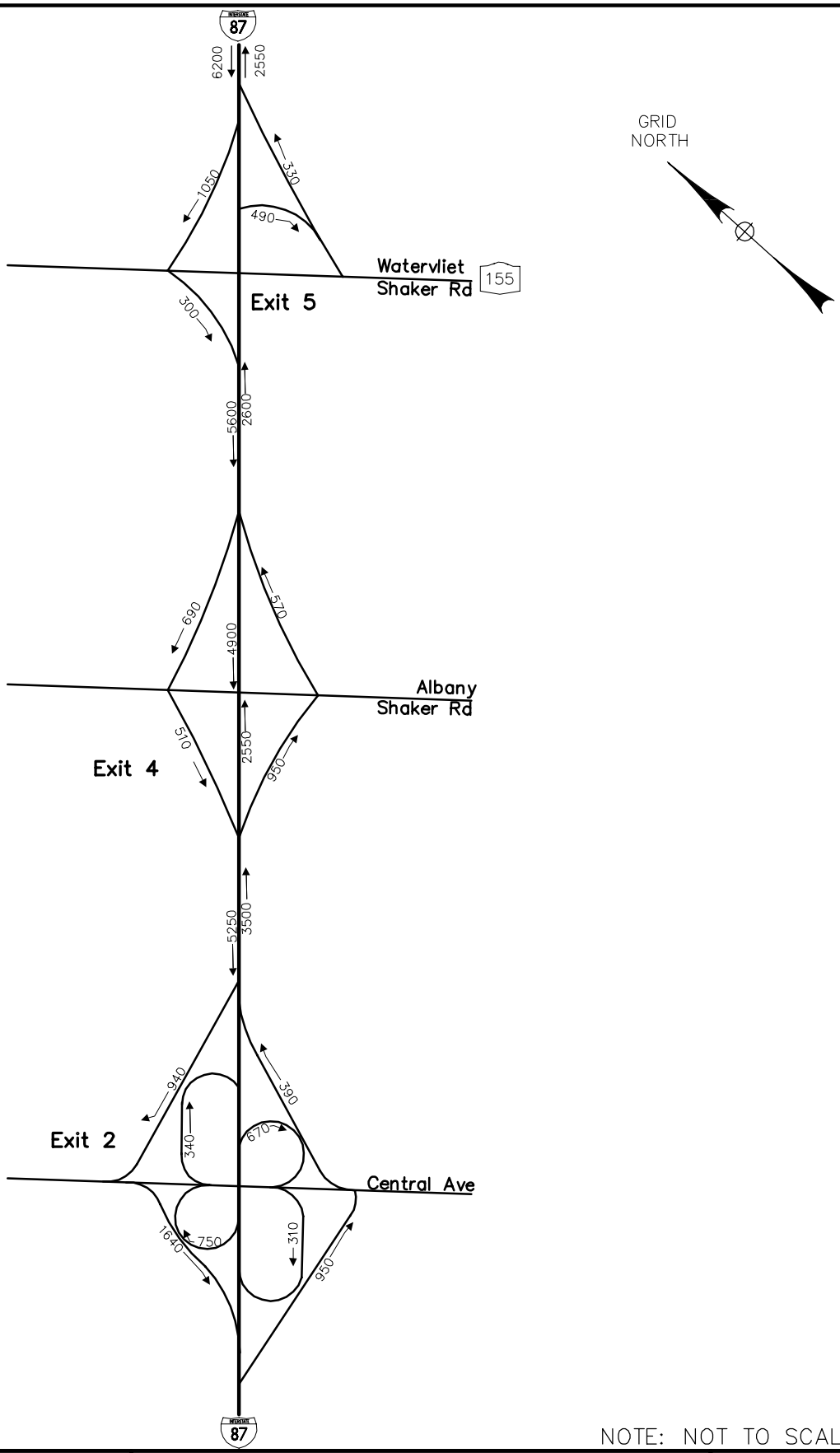
2016 DIAMOND ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-30

DATE: 8/13

Saved: 12/31/2012 11:06:25 AM PLotted: 8/27/2013 11:03:00 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2016 PM DIAMOND HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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2026 DIAMOND ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–31

DATE: 8/13

Saved: 12/31/2012 11:06:23 AM PLotted: 8/27/2013 11:04:21 AM User: Gray, Timmalyn
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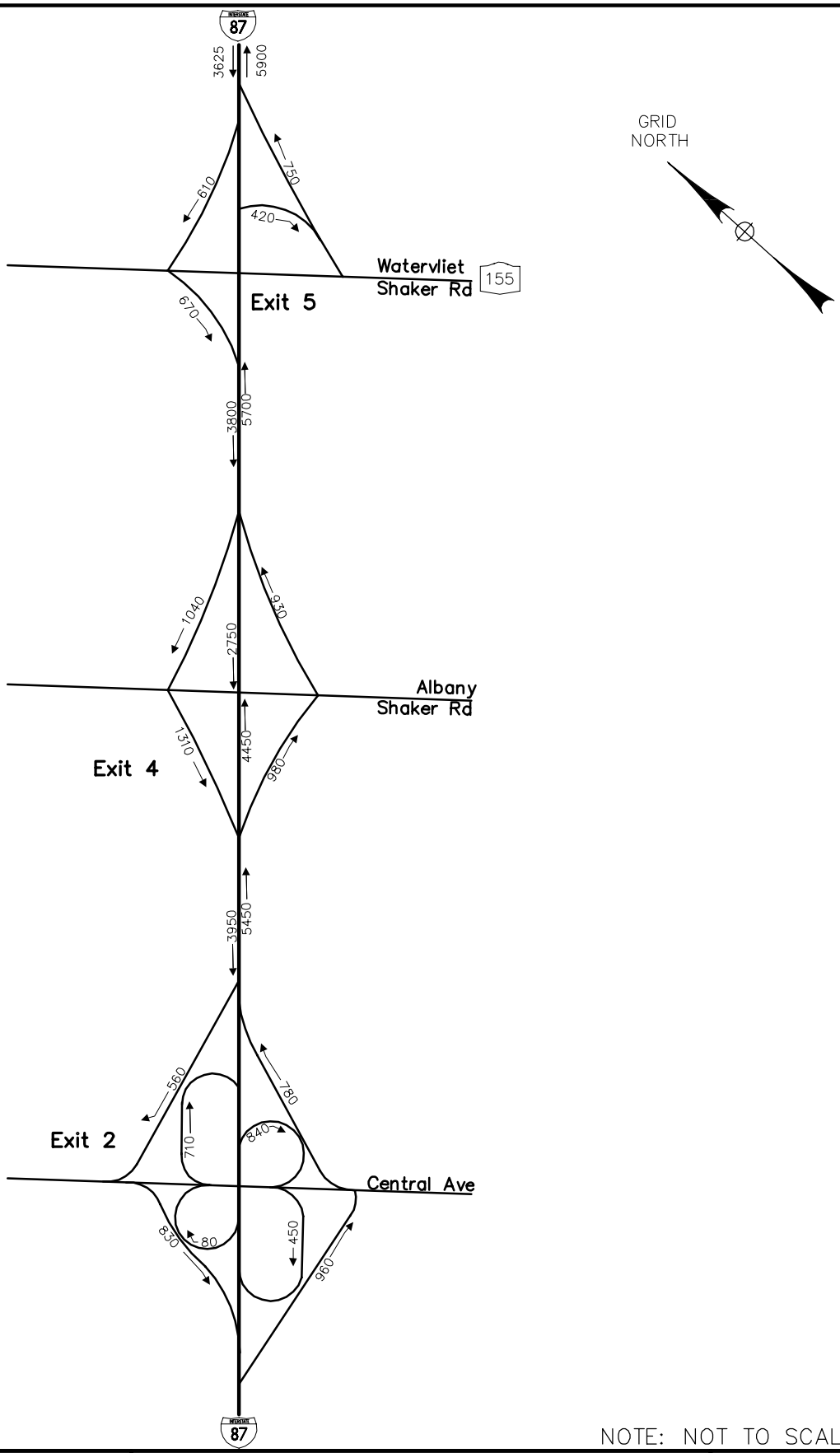

NOTE: NOT TO SCALE

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2026 DIAMOND ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-32

DATE: 8/13

Saved: 12/31/2012 11:06:22 AM PLotted: 8/27/2013 11:05:51 AM User: Gray, Timmalyn
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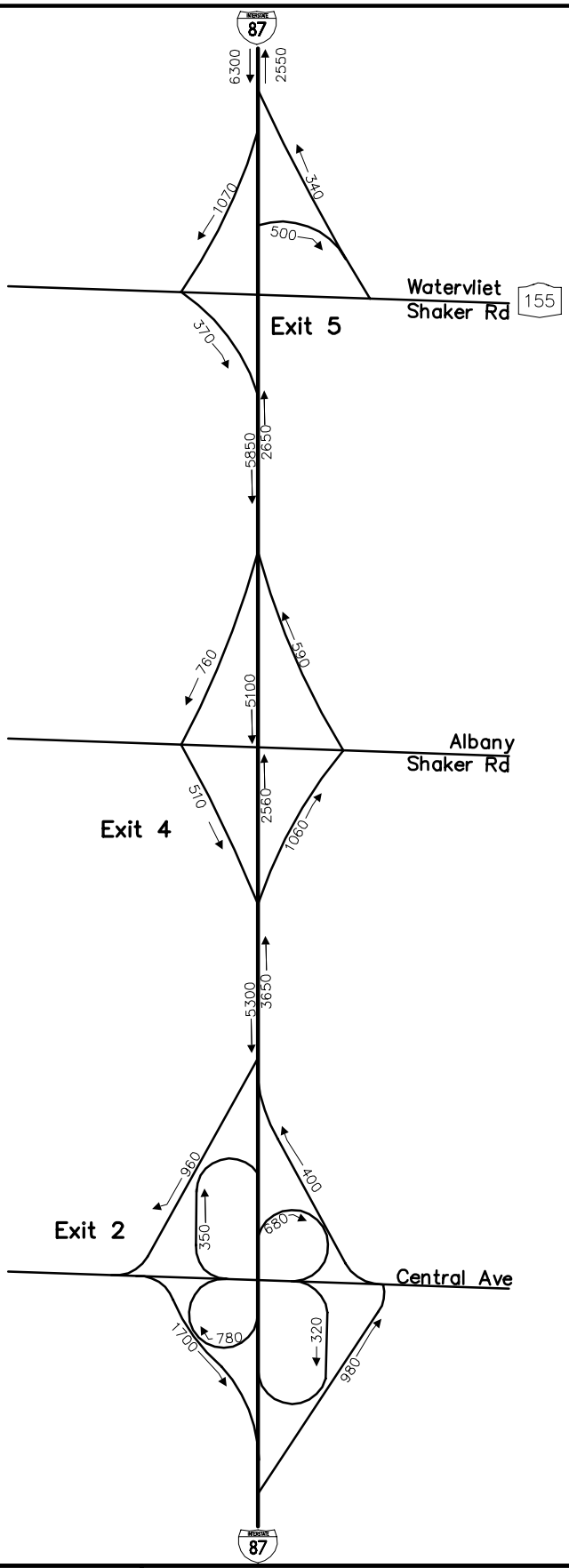

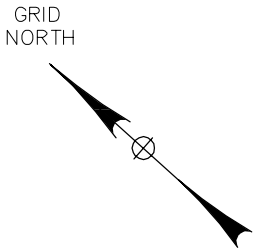

NOTE: NOT TO SCALE

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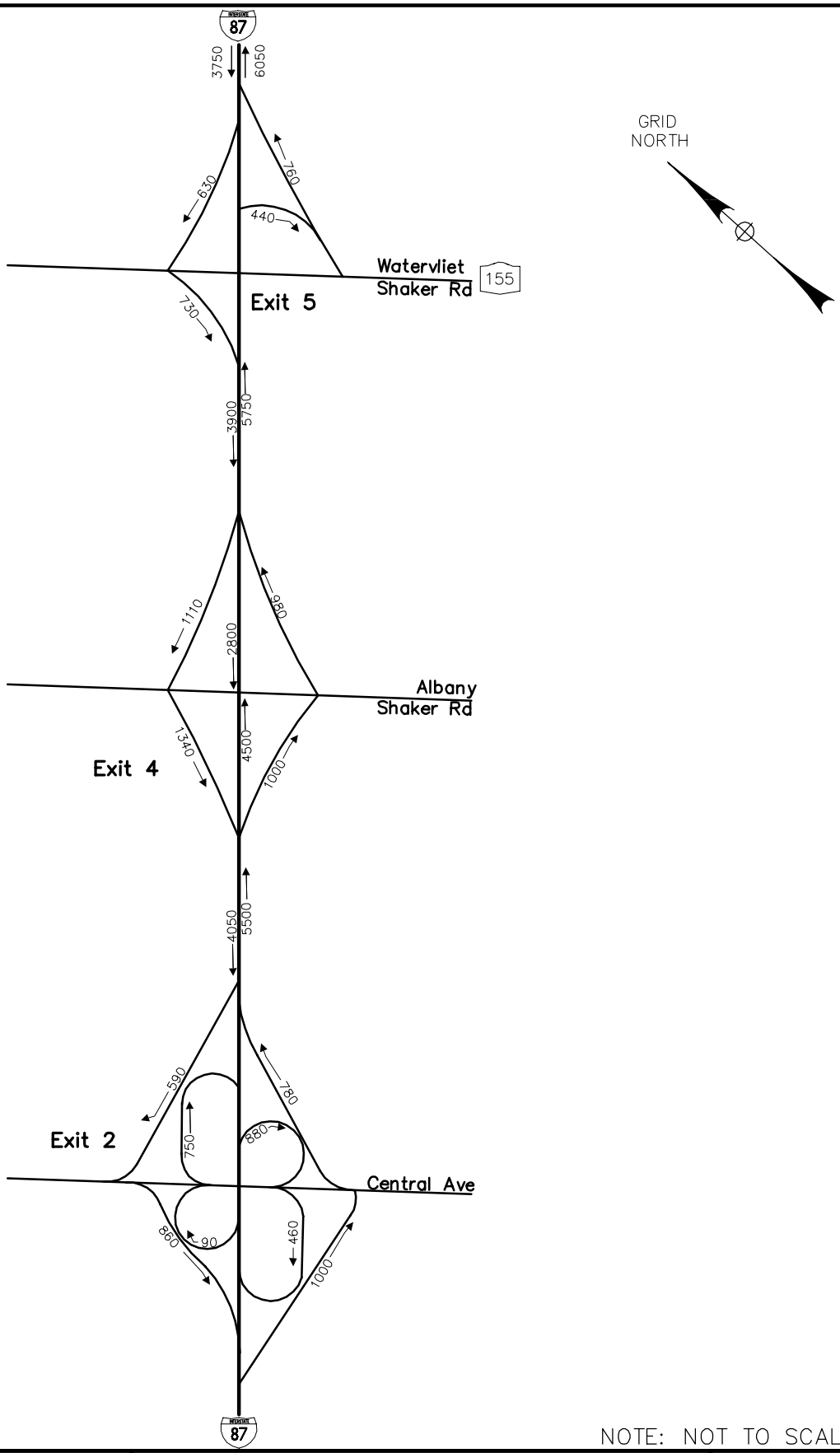
2036 DIAMOND ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–33

DATE: 8/13

Saved: 12/31/2012 11:06:20 AM PLotted: 8/27/2013 11:13:36 AM User: Gray, Timmalyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2036 AM DIAMOND HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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2036 DIAMOND ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-34

DATE: 8/13

Saved: 12/31/2012 11:06:19 AM PLotted: 8/27/2013 11:27:58 AM User: Gray, Timmalyn
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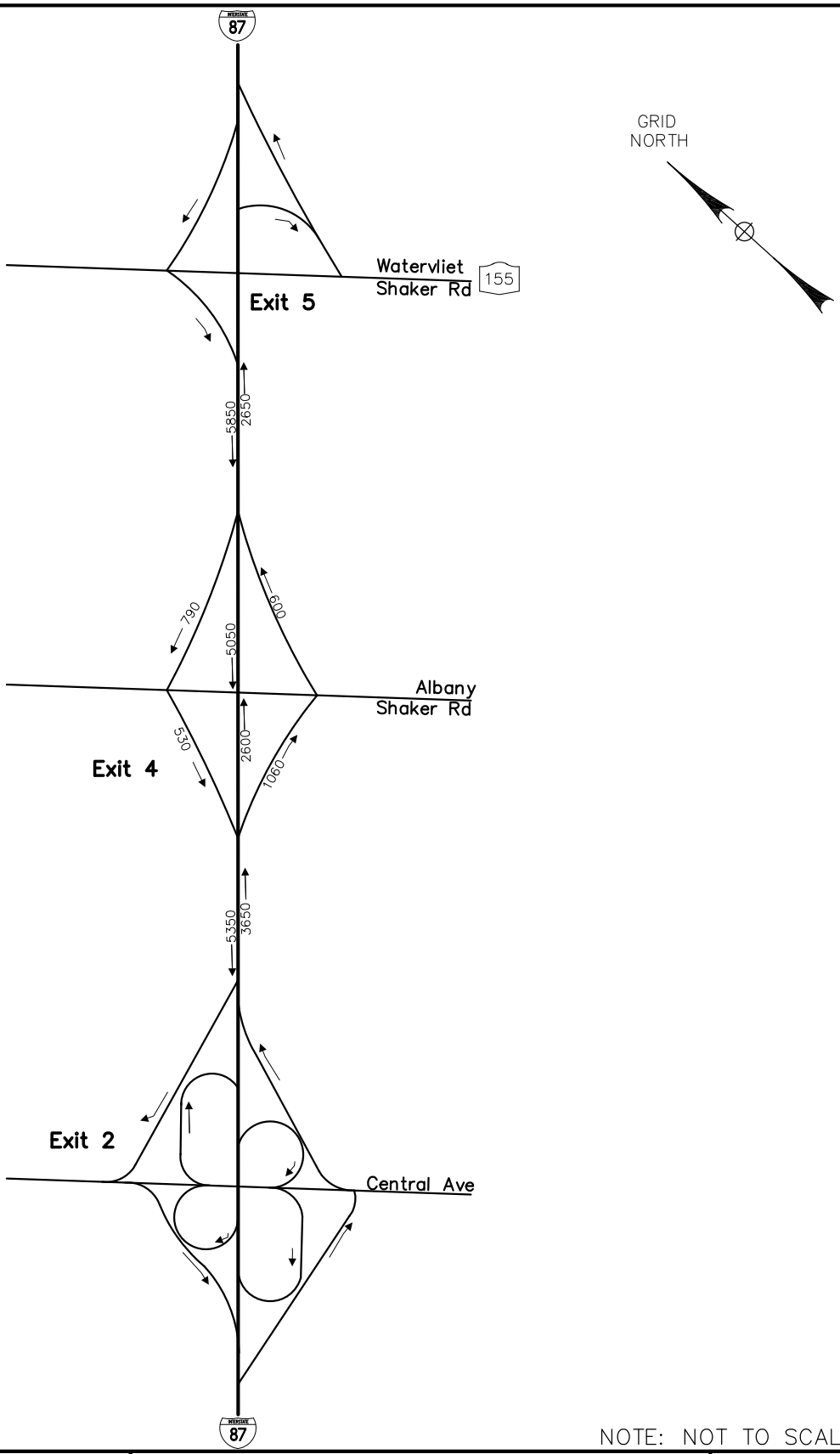

NOTE: NOT TO SCALE

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2046 DIAMOND ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–35

DATE: 12/12

Saved: 2/24/2012 9:17:49 AM PLotted: 12/31/2012 9:49:29 AM User: Kinley, James
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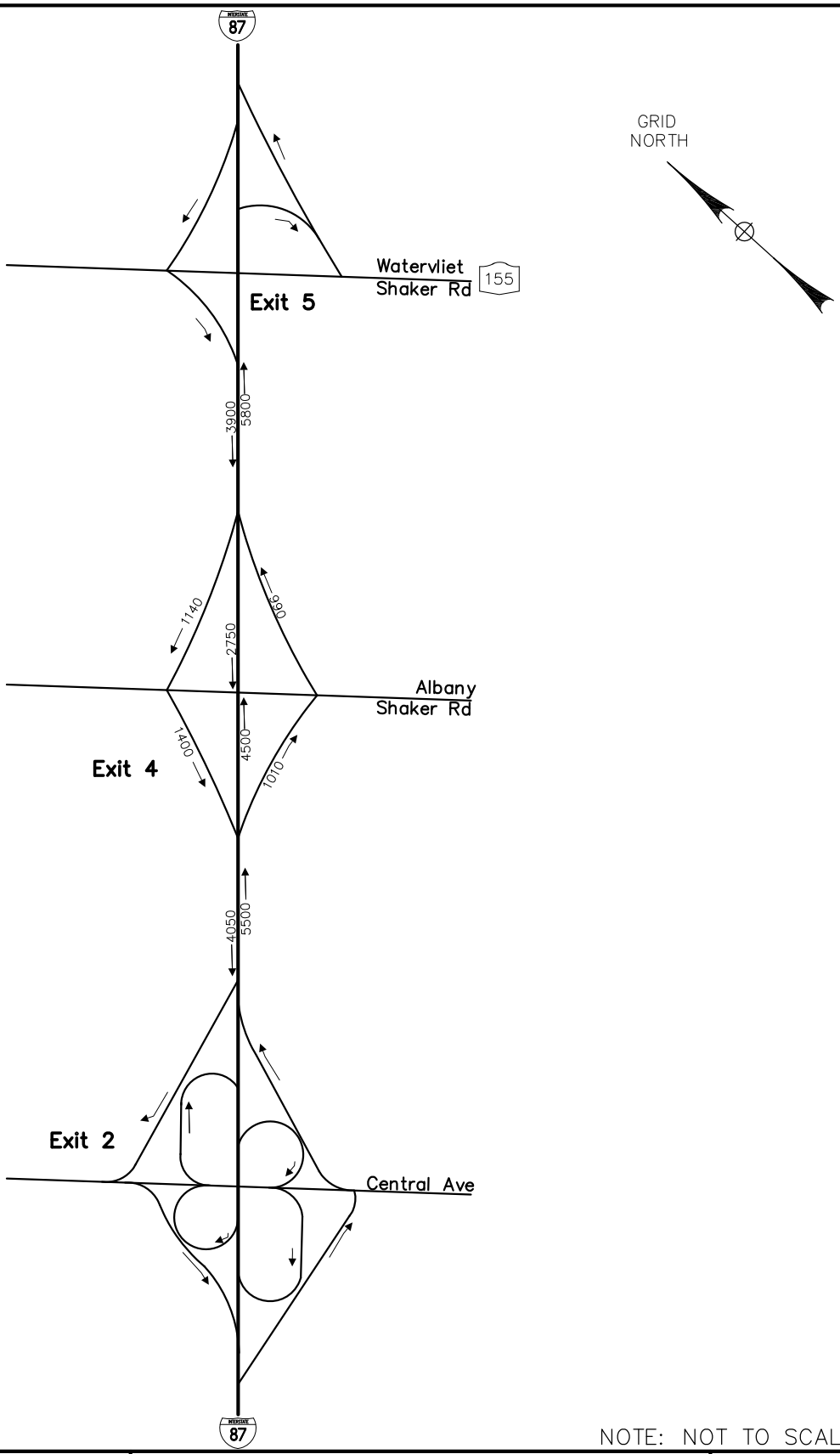

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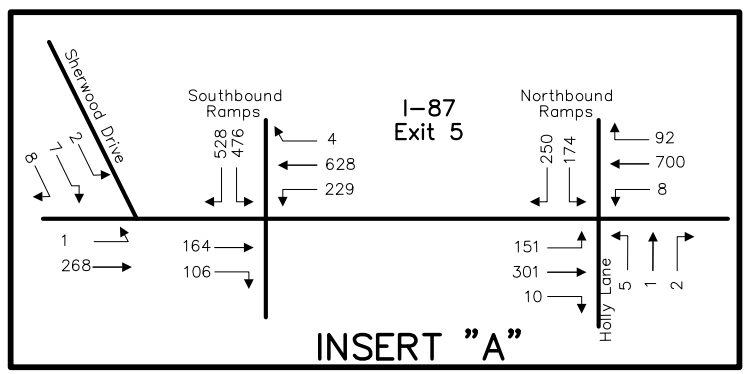
2046 DIAMOND ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

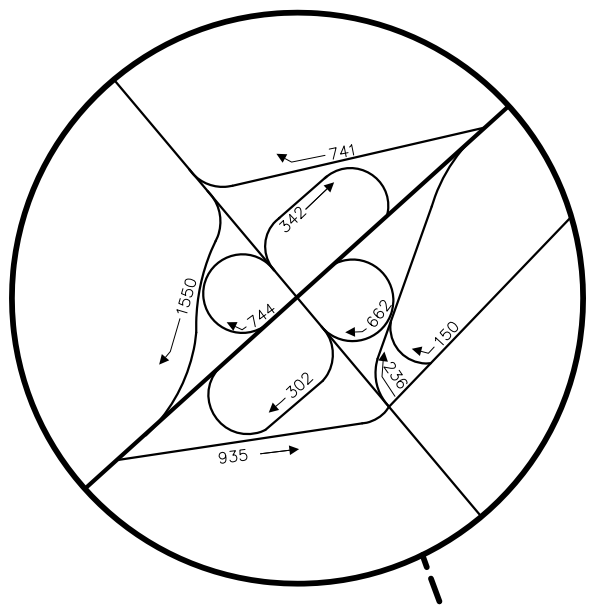
INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

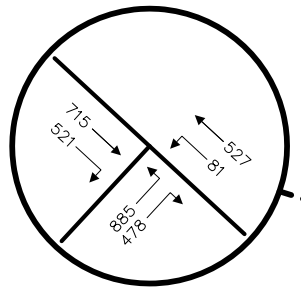
FIGURE
F–36

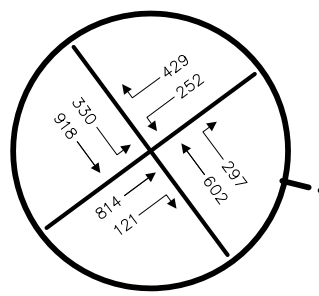
DATE: 12/12

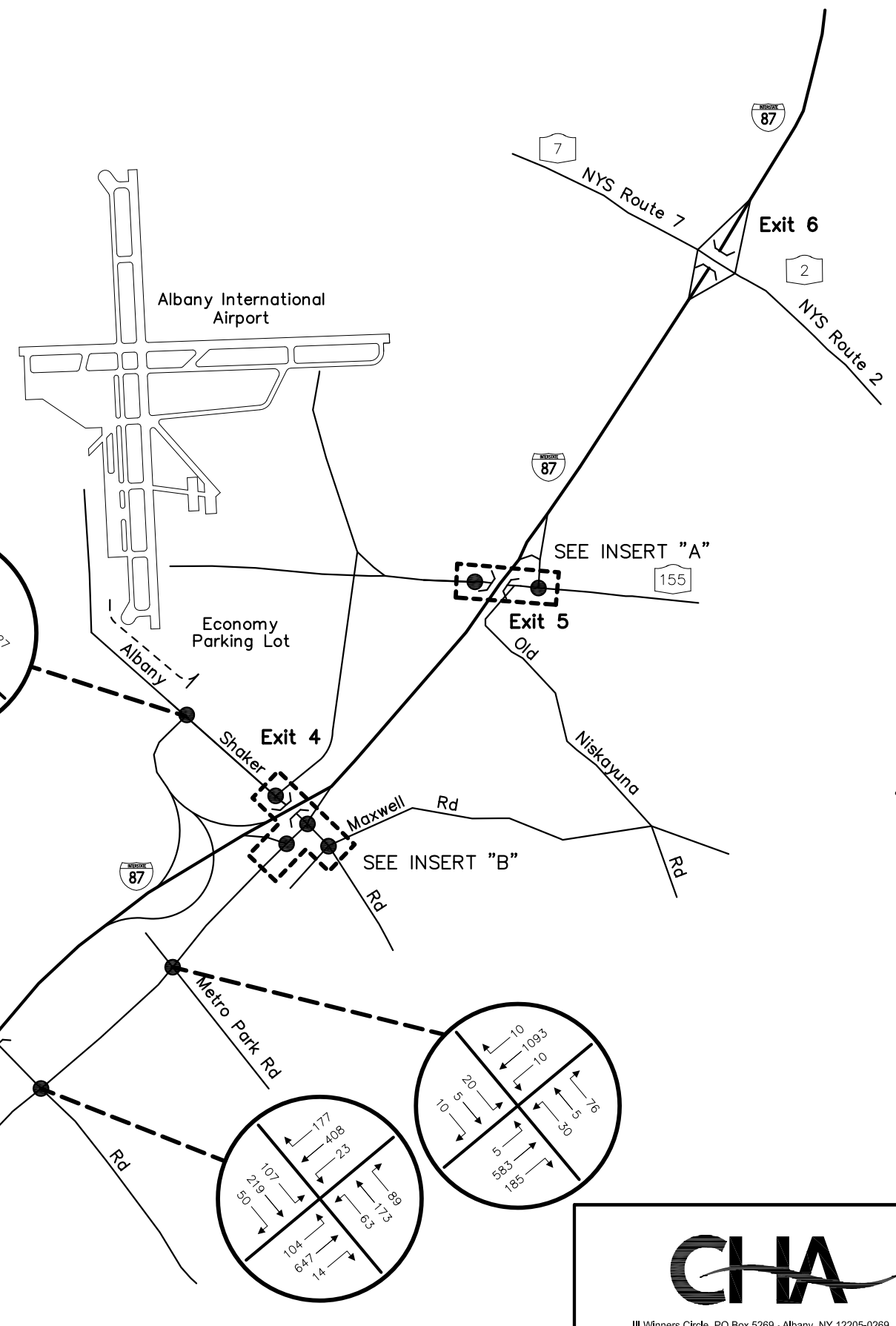
Saved: 2/24/2012 9:17:46 AM PLotted: 12/31/2012 9:50:27 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2046 PM DIAMOND HIGHWAY VOL.DWG

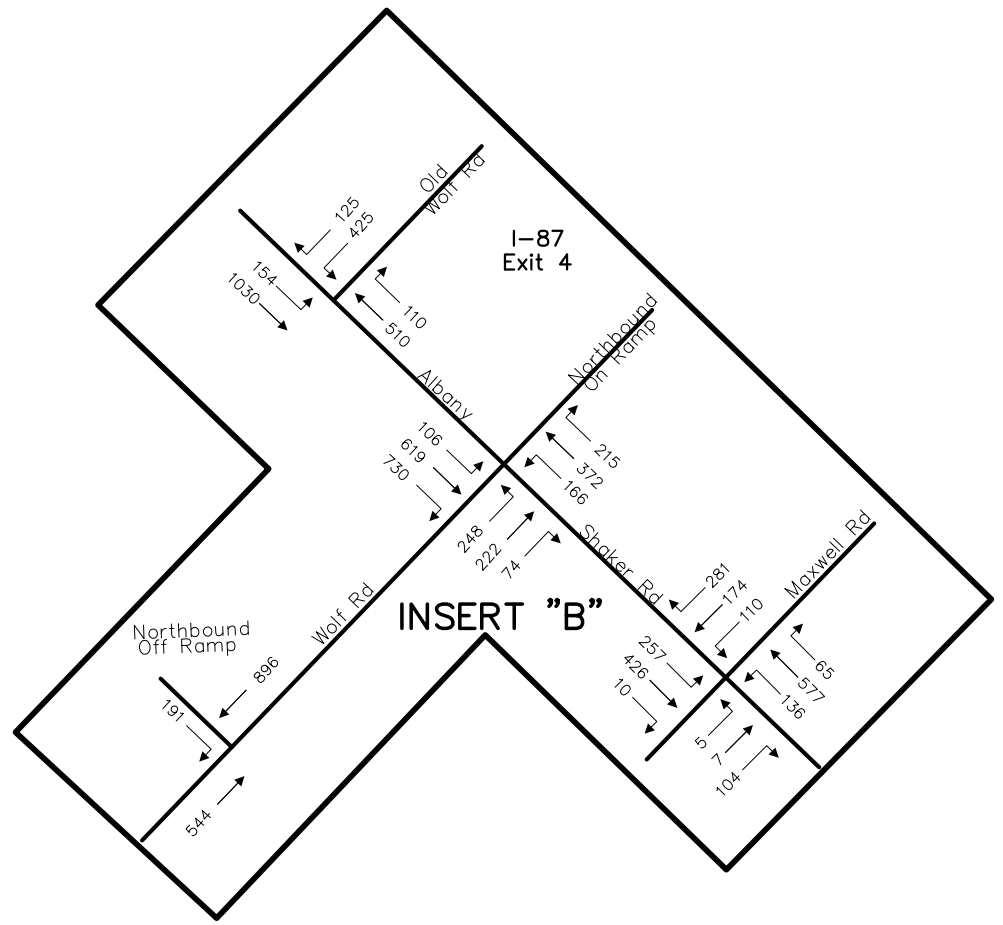












NOTE: NOT TO SCALE

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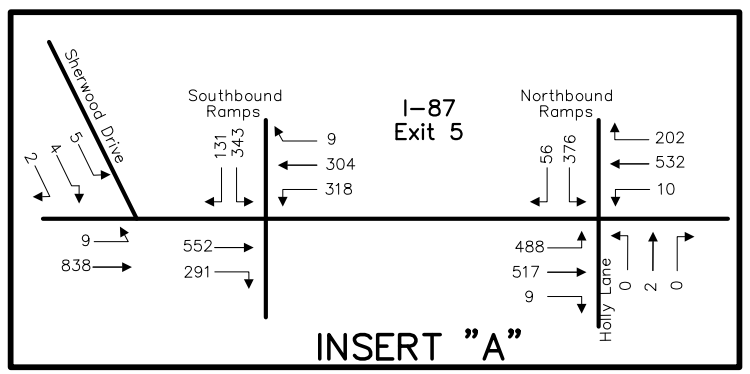
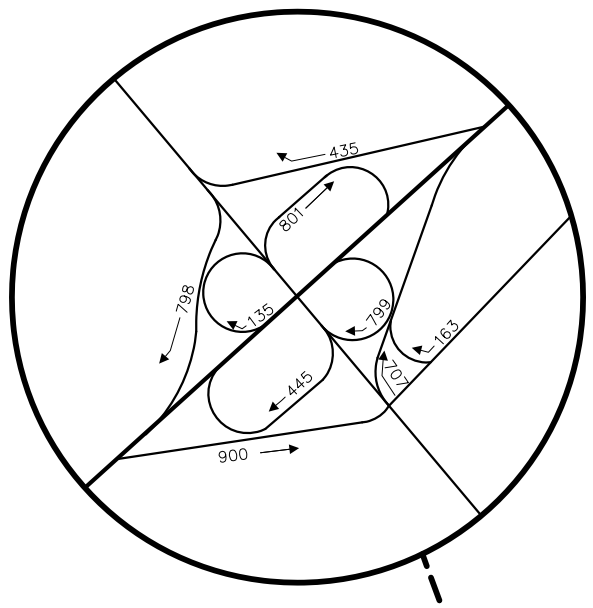
2016 FLYOVER ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

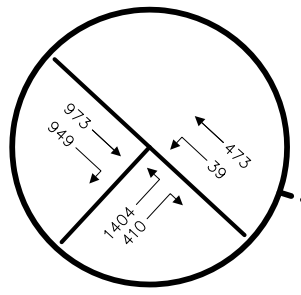
INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

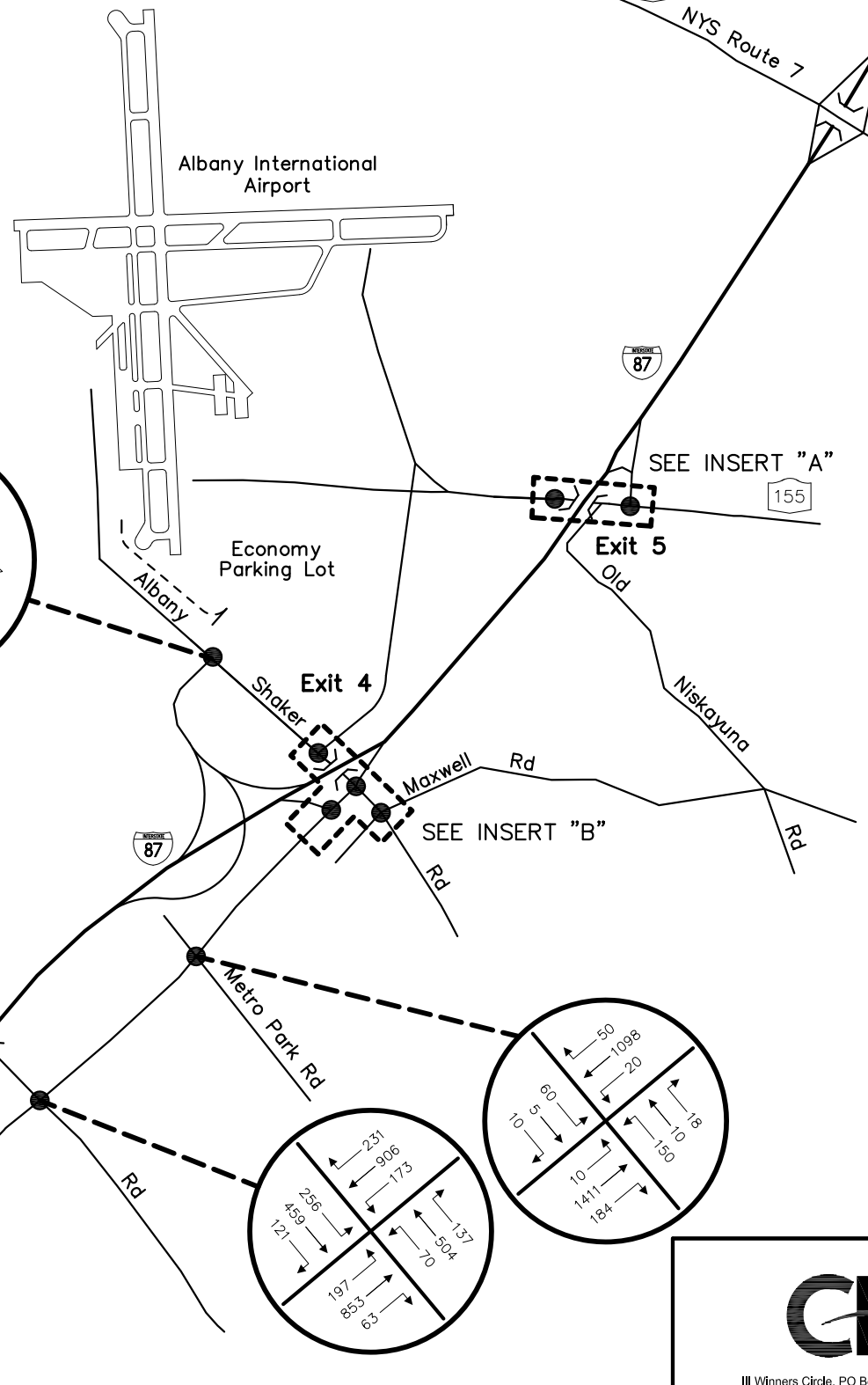
FIGURE
F–37
DATE:12/12

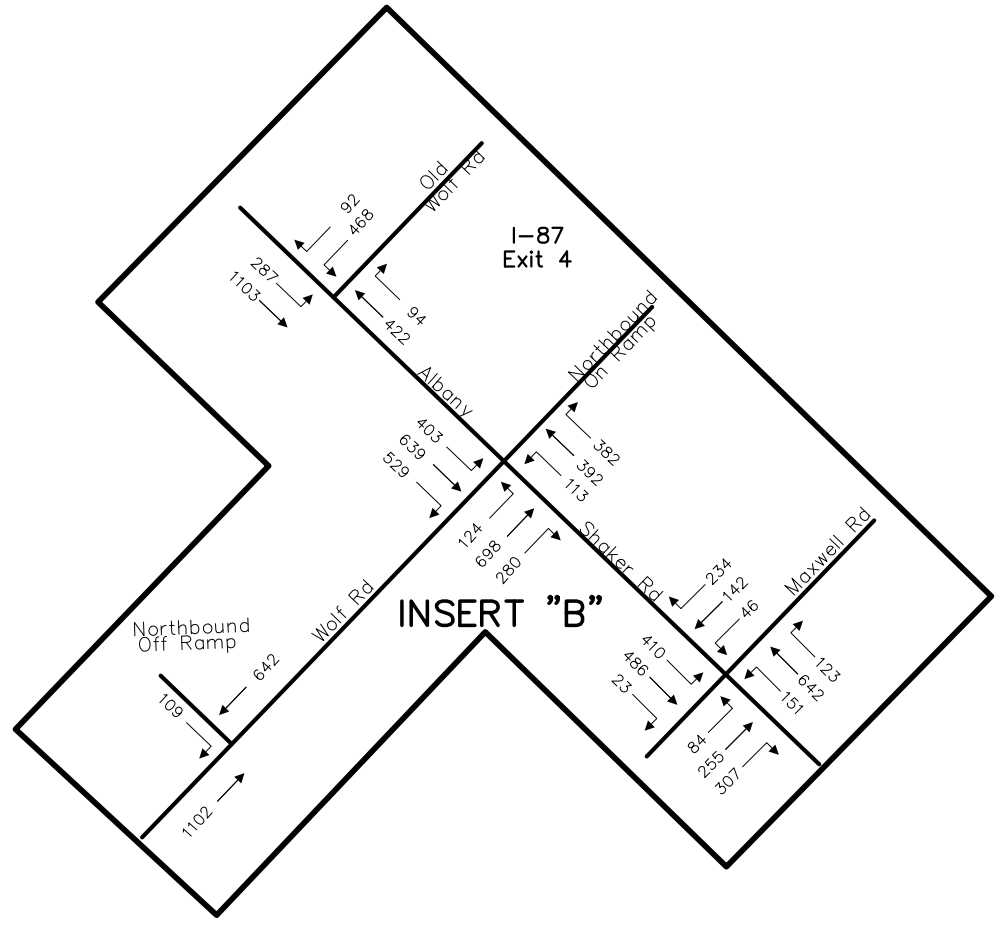
Saved: 1/9/2012 4:33:45 PM PLotted: 12/31/2012 8:49:26 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2016 AM FLYOVER.DWG











GRID NORTH

NOTE: NOT TO SCALE

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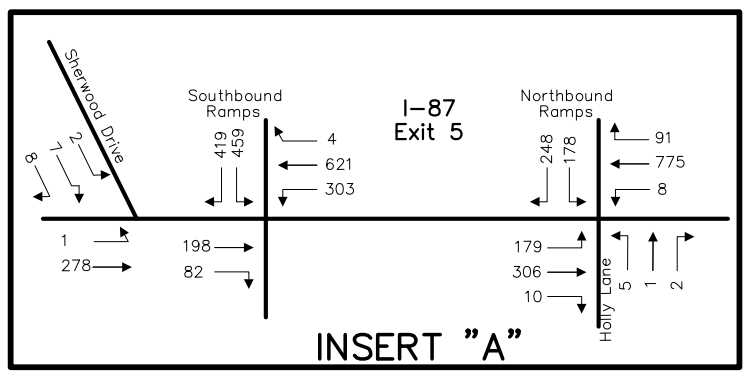
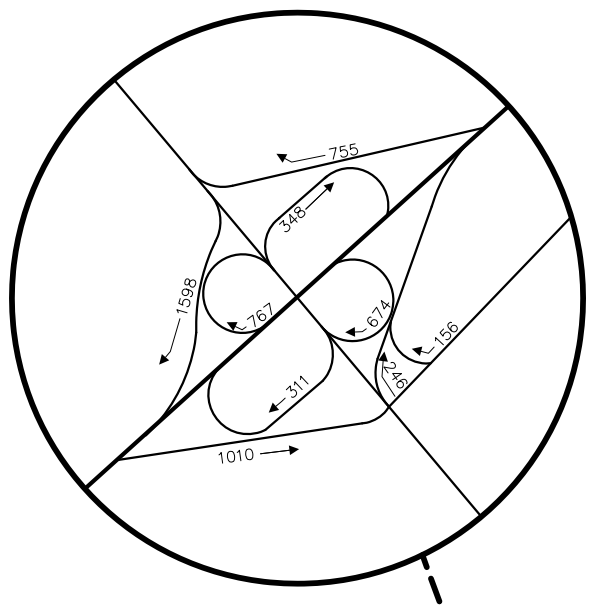
2016 FLYOVER ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

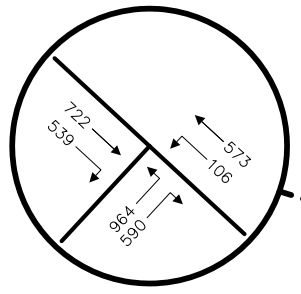
INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

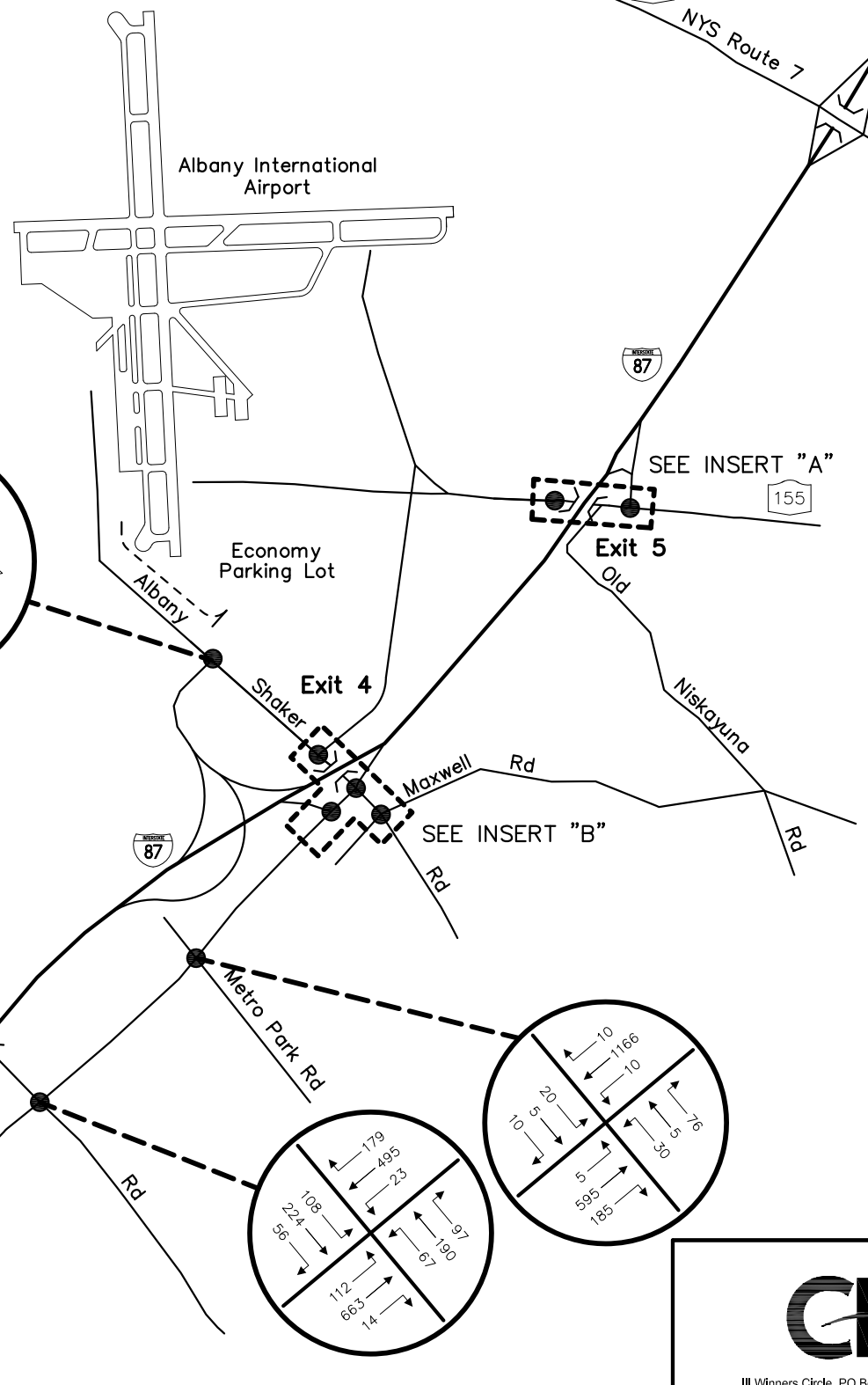
FIGURE
F–38
DATE:12/12

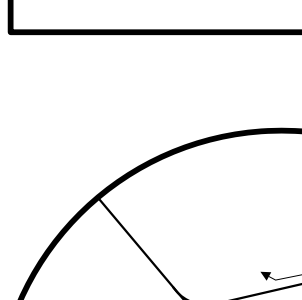
Saved: 12/31/2012 8:50:01 AM PLotted: 12/31/2012 8:50:27 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2016 PM FLYOVER.DWG

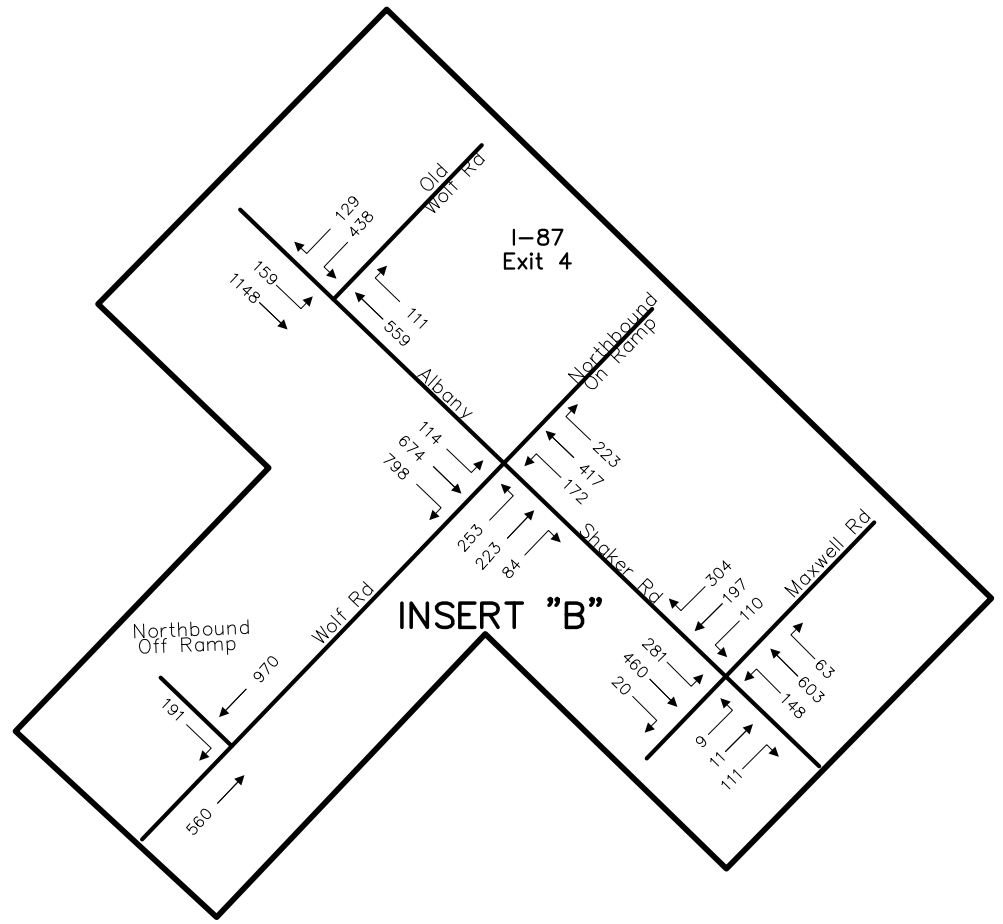












GRID NORTH

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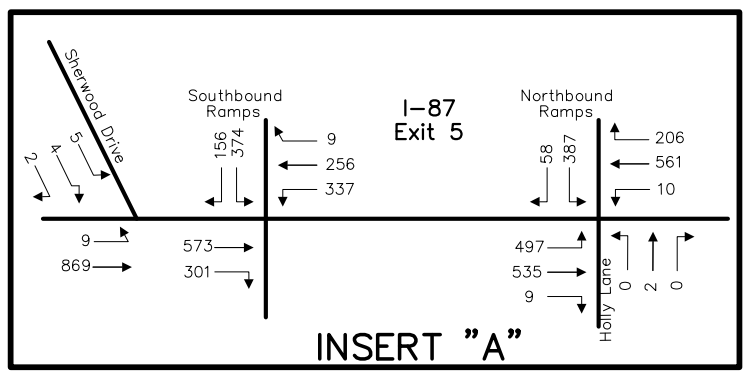
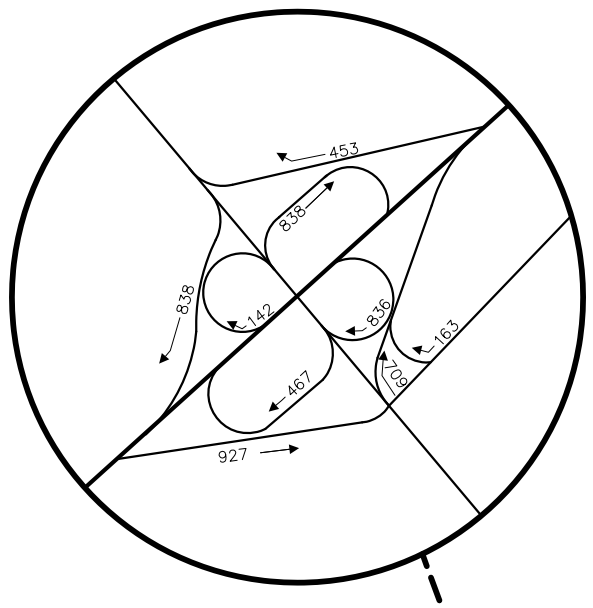
2026 FLYOVER ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

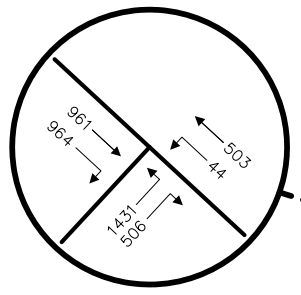
INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

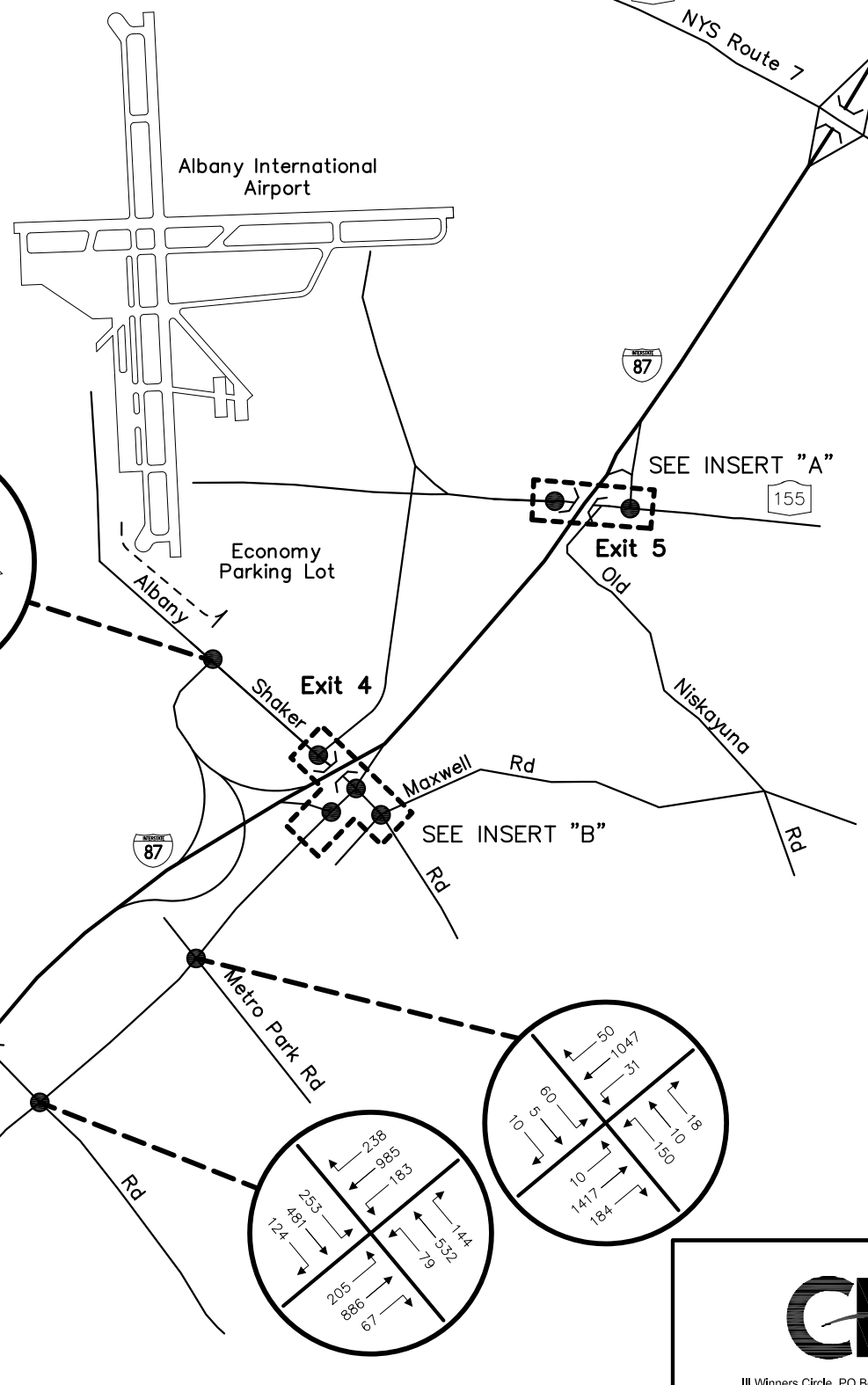
FIGURE
F–39
DATE:12/12

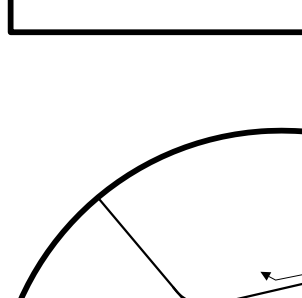
Saved: 1/9/2012 5:16:31 PM PLotted: 12/31/2012 8:52:29 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2026 AM FLYOVER.DWG

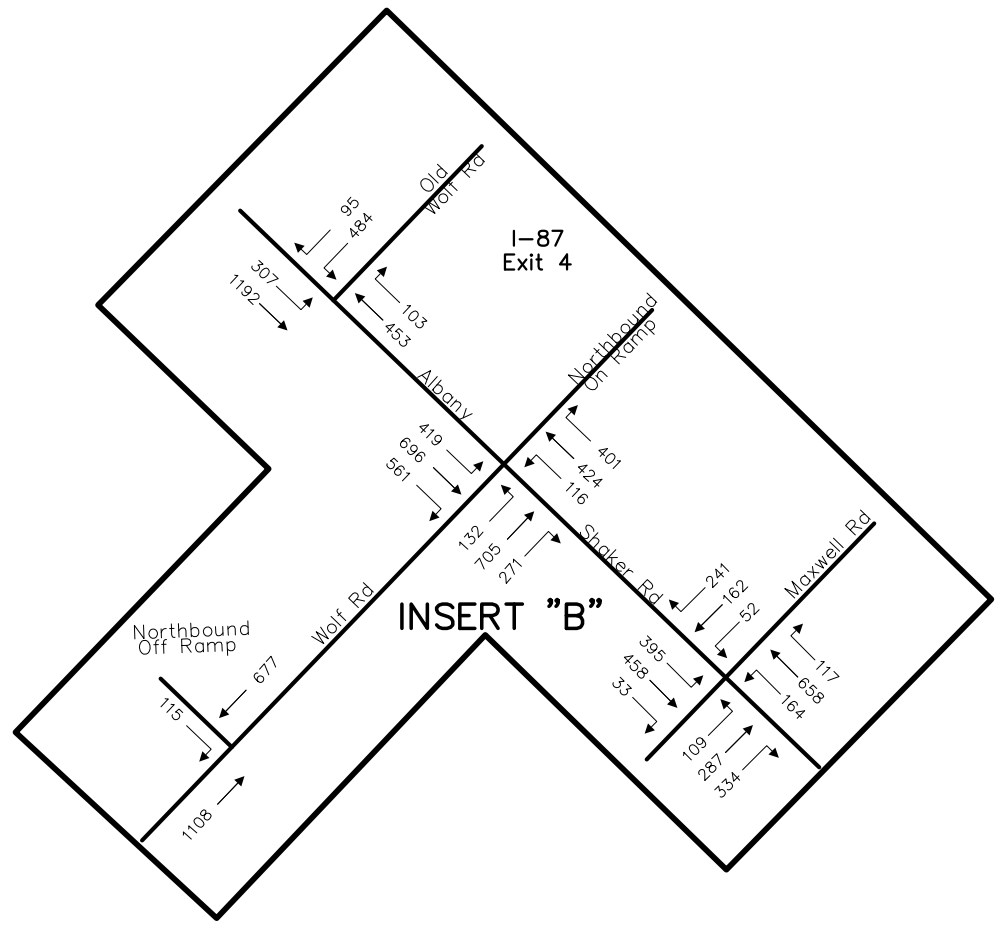












NOTE: NOT TO SCALE

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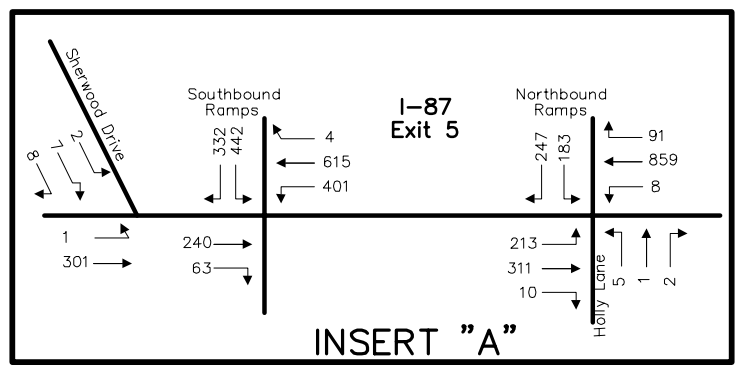
2026 FLYOVER ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F–40
DATE:12/12

Saved: 1/9/2012 5:16:06 PM PLotted: 12/31/2012 8:54:20 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2026 PM FLYOVER.DWG



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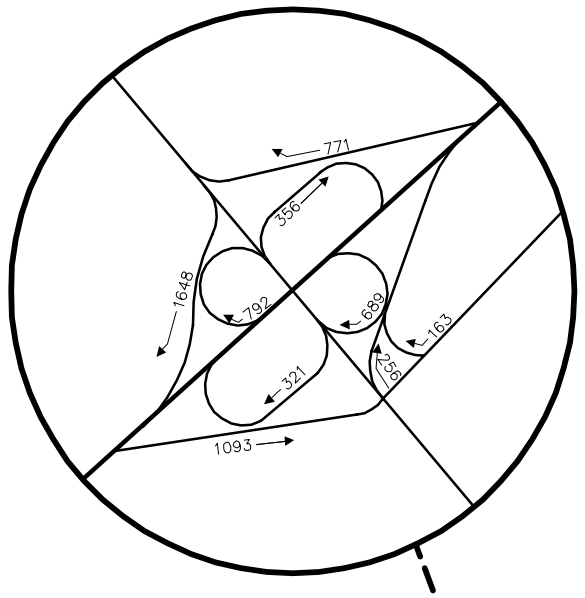

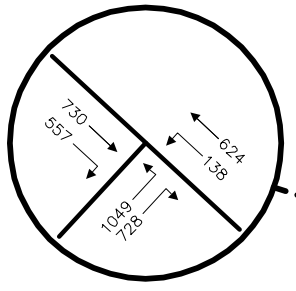

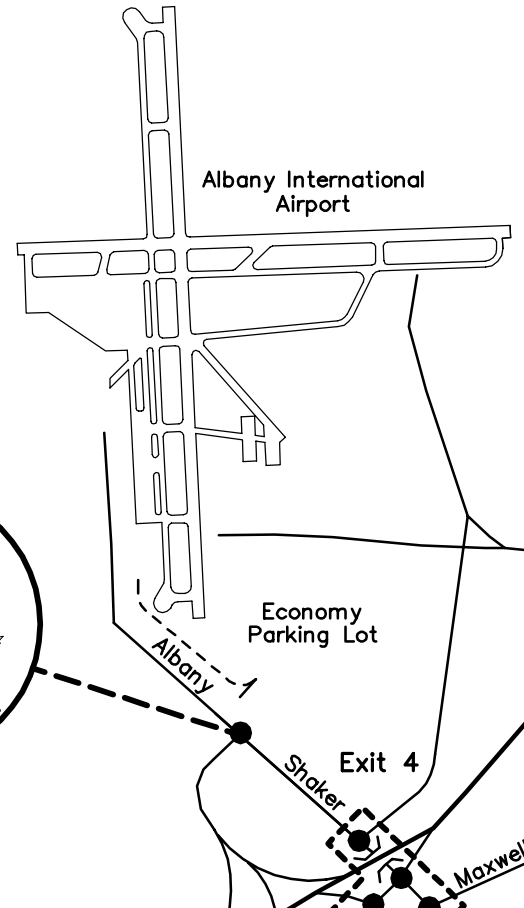

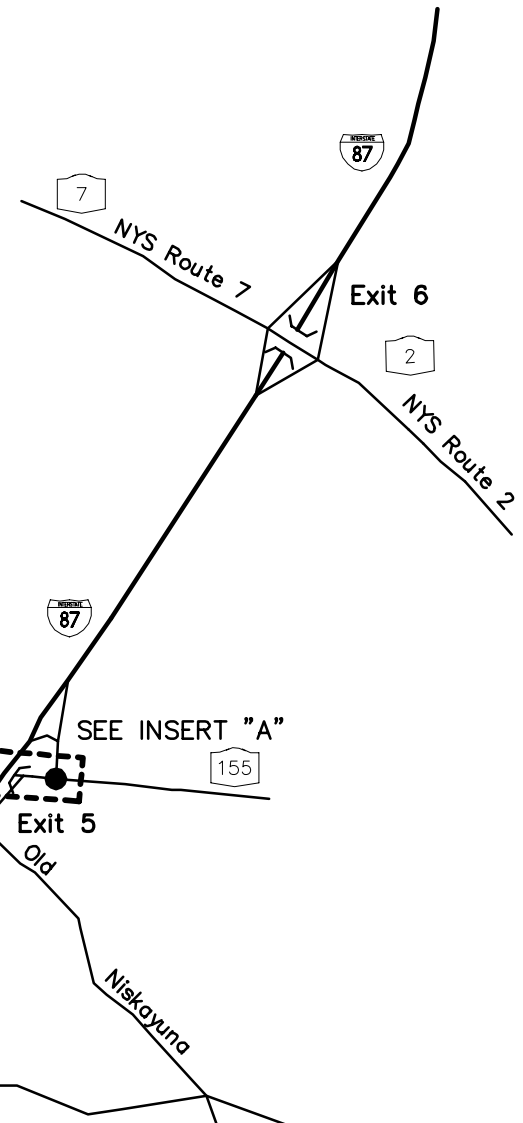

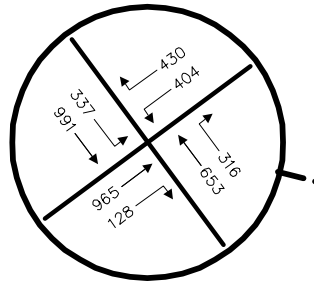

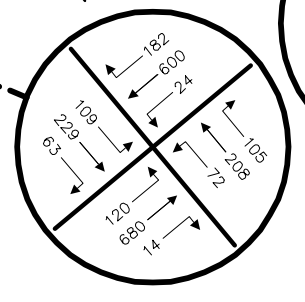

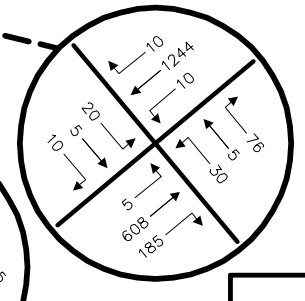

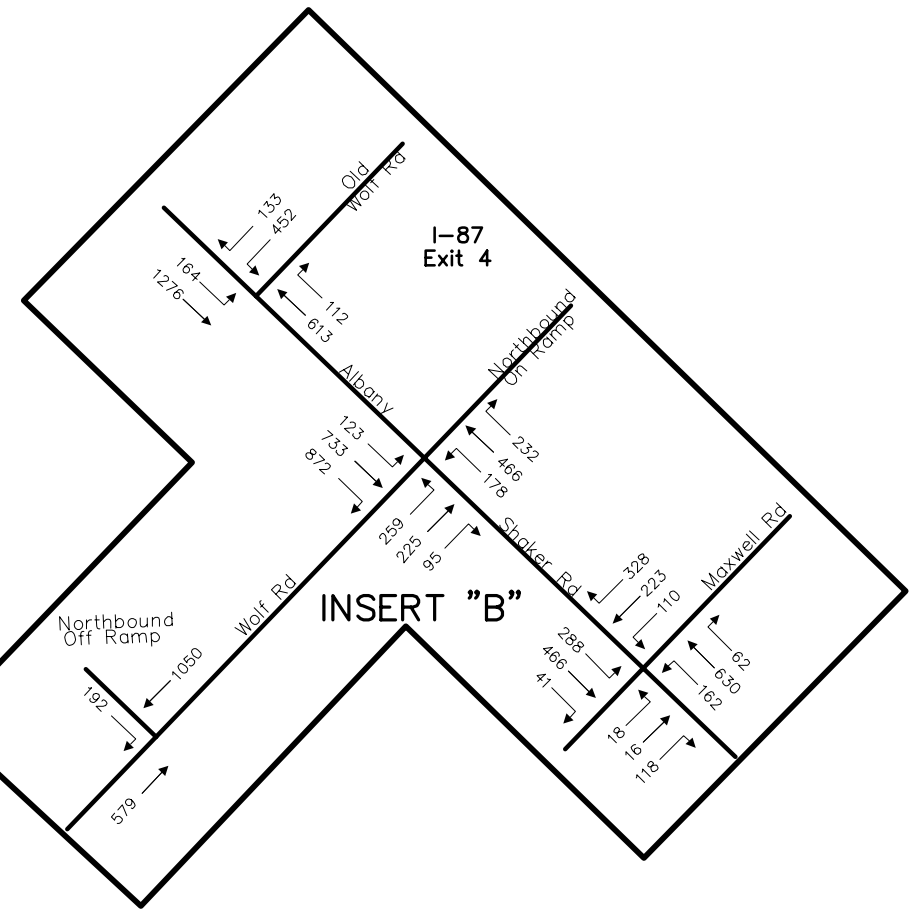

INSERT "B"

GRID NORTH

NOTE: NOT TO SCALE

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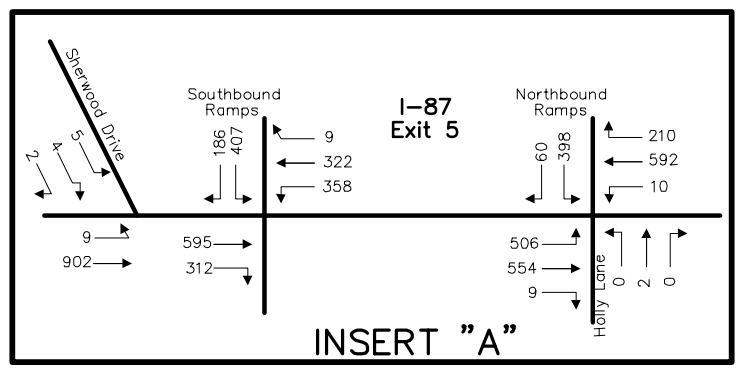
2036 FLYOVER ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

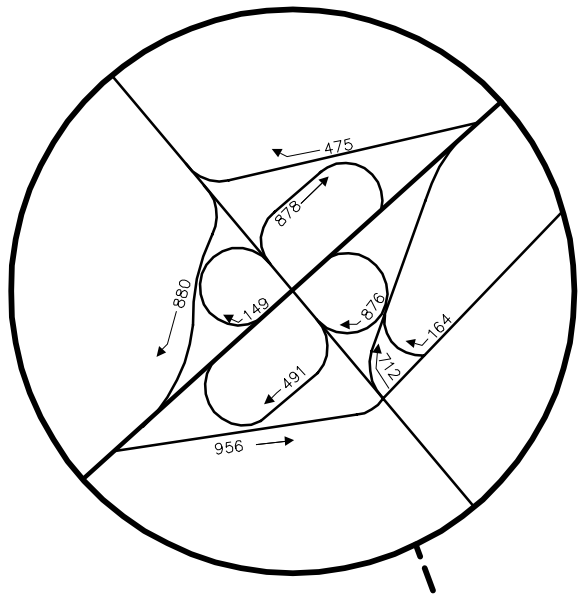
FIGURE
F–41

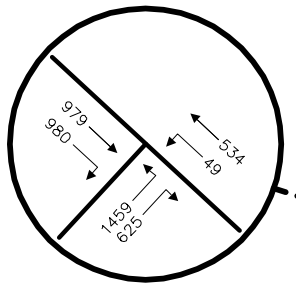
DATE: 8/13

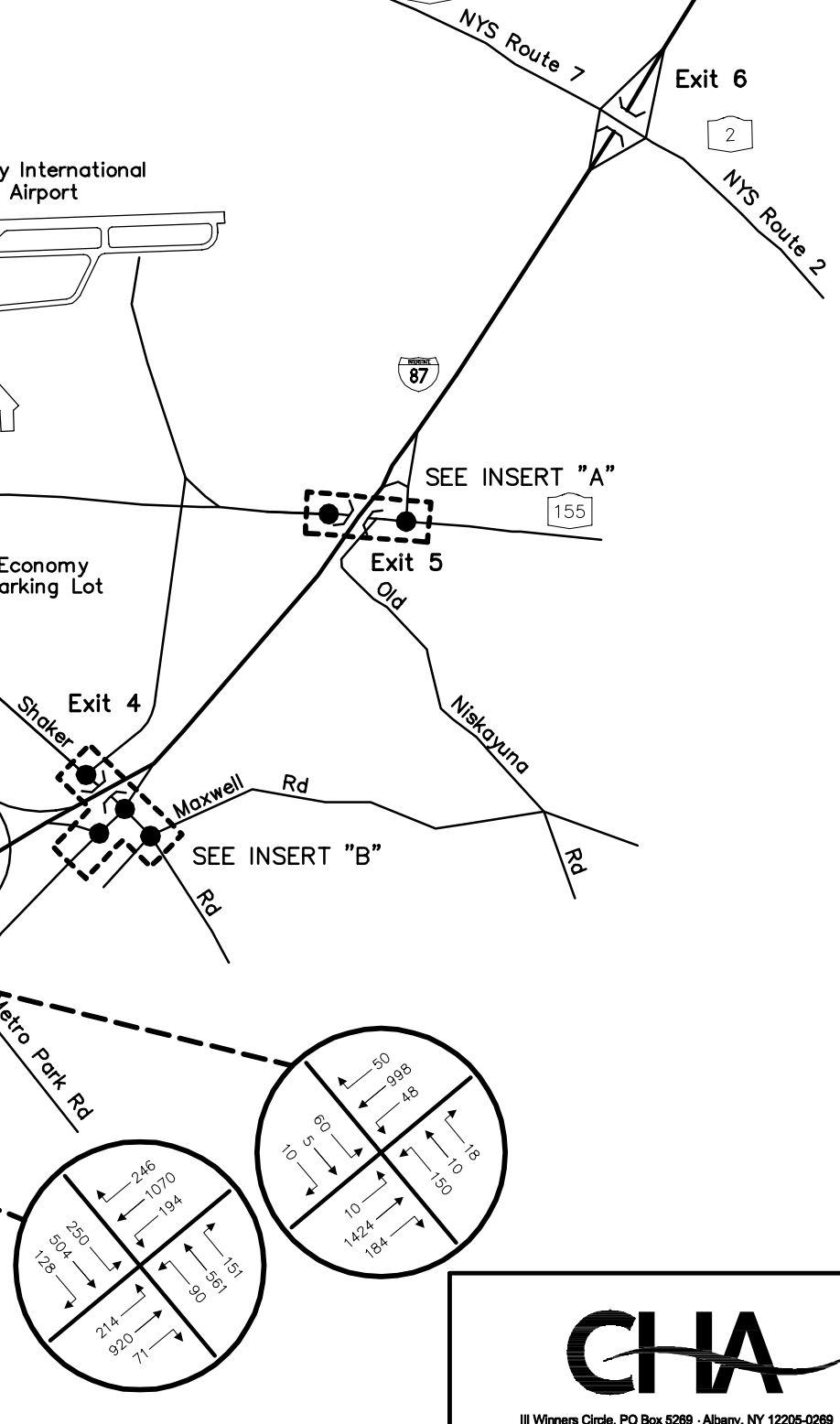
Saved: 8/27/2013 10:09:19 AM PLotted: 8/27/2013 10:09:37 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2036 AM FLYOVER.DWG

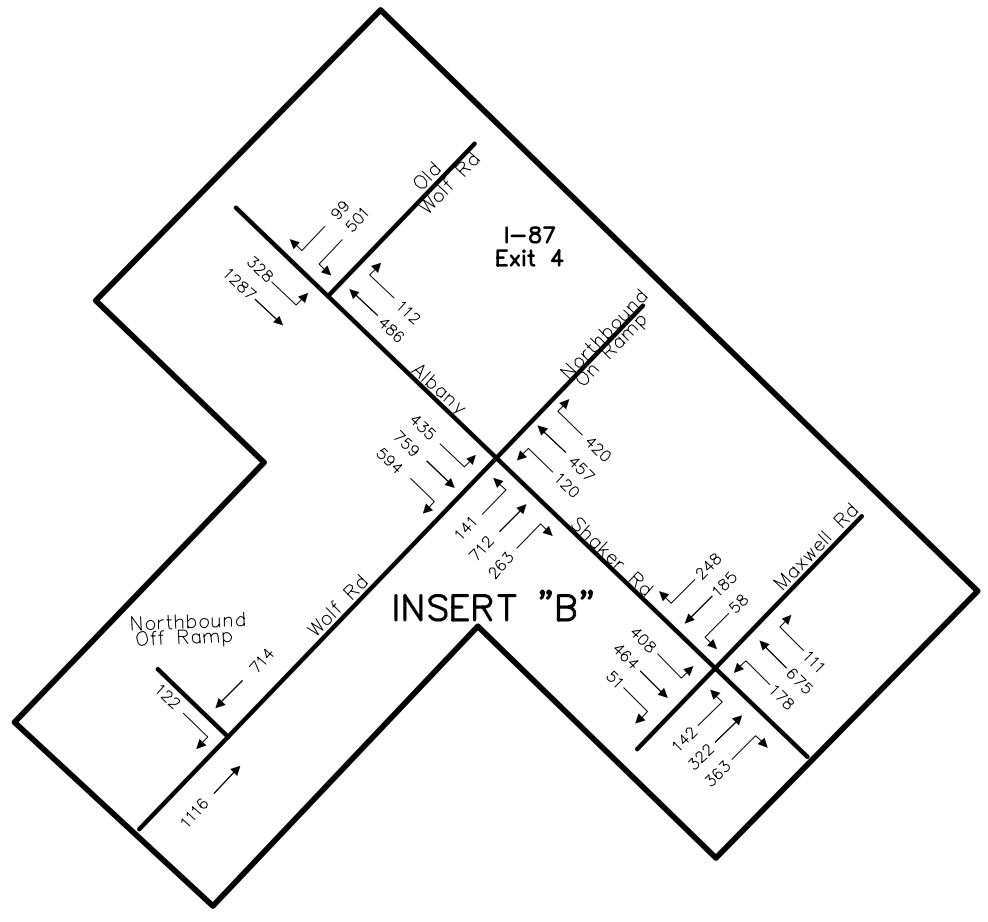


INSERT "A"









INSERT "B"

NOTE: NOT TO SCALE

GRID NORTH

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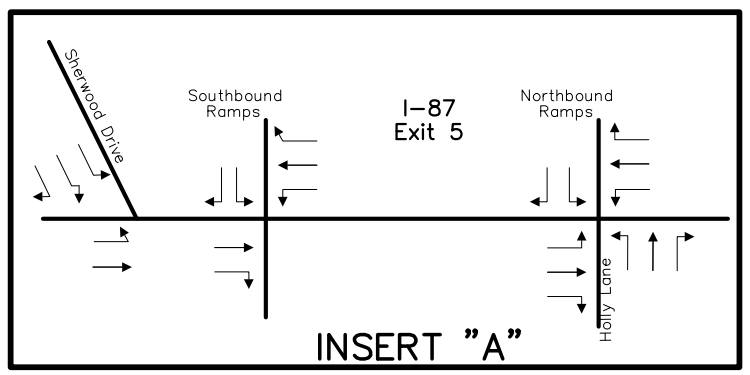
2036 FLYOVER ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

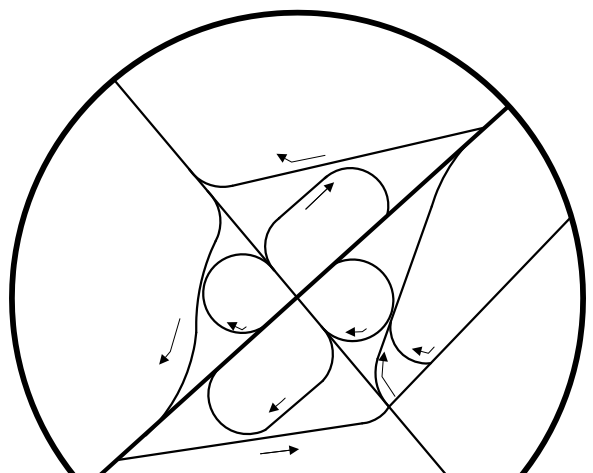
INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS ACCESS IMPROVEMENTS

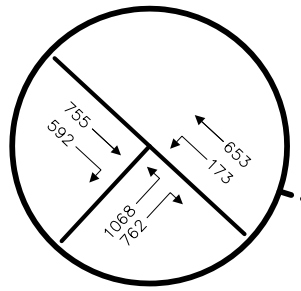
FIGURE F–42

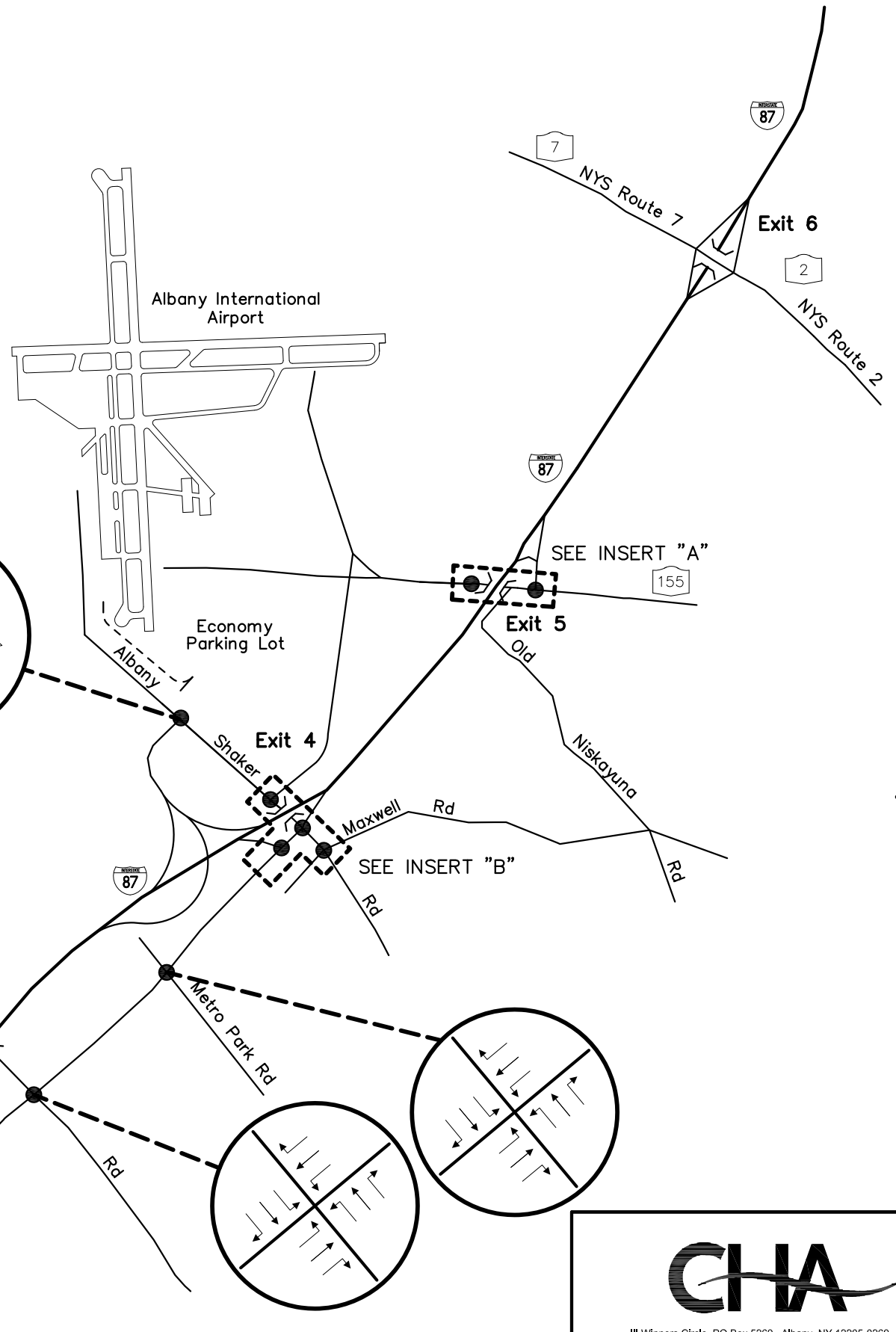
DATE: 8/13

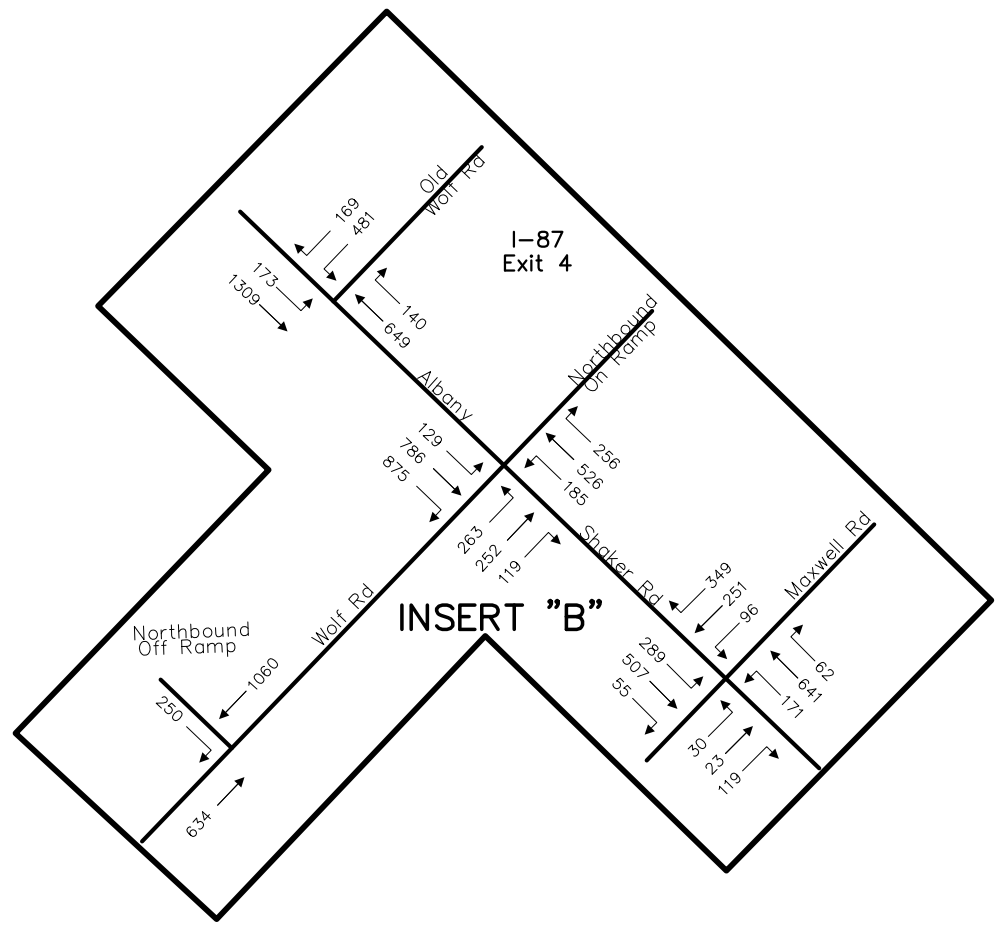
Saved: 8/27/2013 10:13:14 AM PLotted: 8/27/2013 10:13:34 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2036 PM FLYOVER.DWG











GRID NORTH

NOTE: NOT TO SCALE

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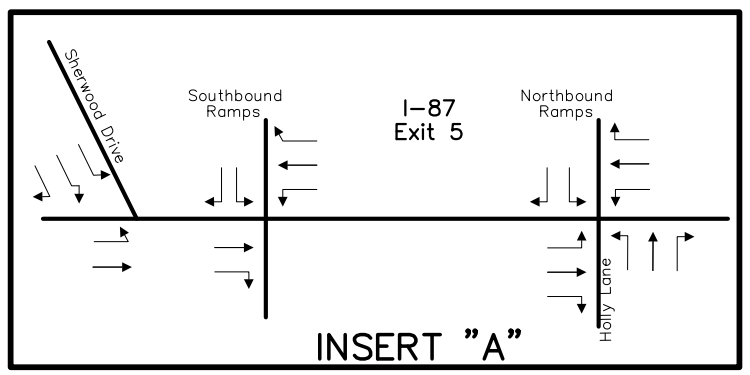
2046 FLYOVER ALTERNATIVE AM PEAK HOUR TRAFFIC VOLUMES

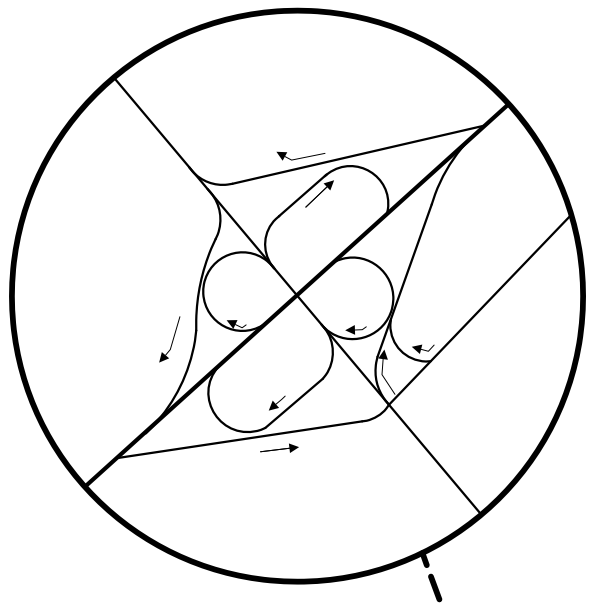
INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

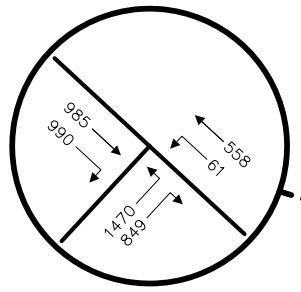
FIGURE
F–43

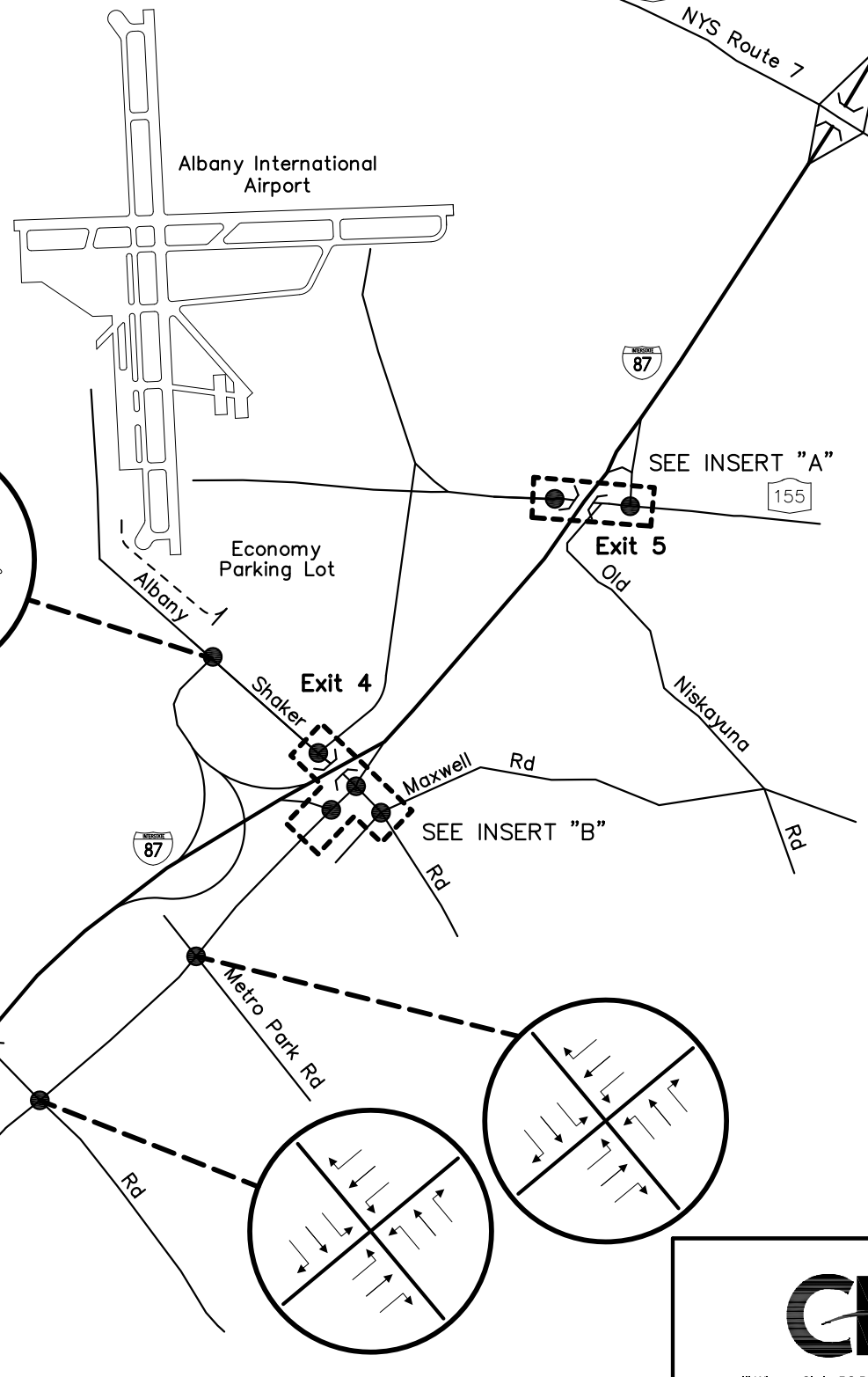
DATE:12/12

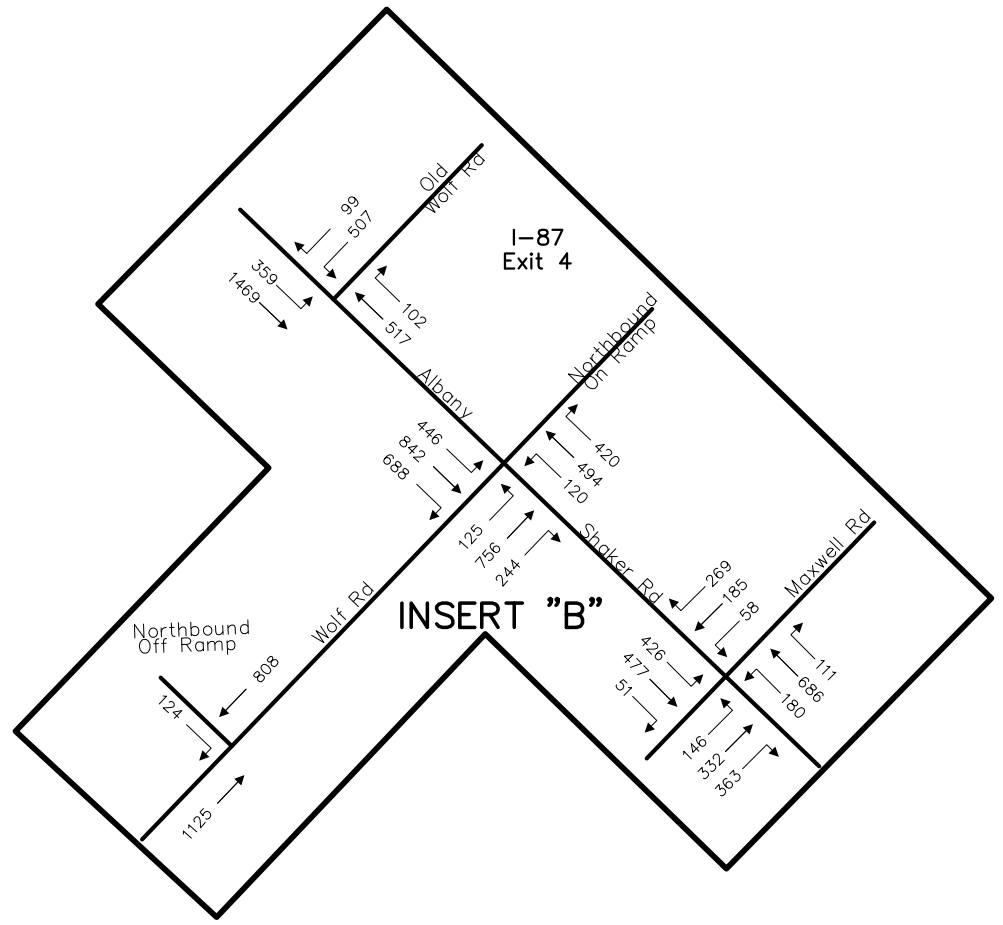
Saved: 1/9/2012 5:14:50 PM PLotted: 12/31/2012 8:58:18 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2046 AM FLYOVER.DWG











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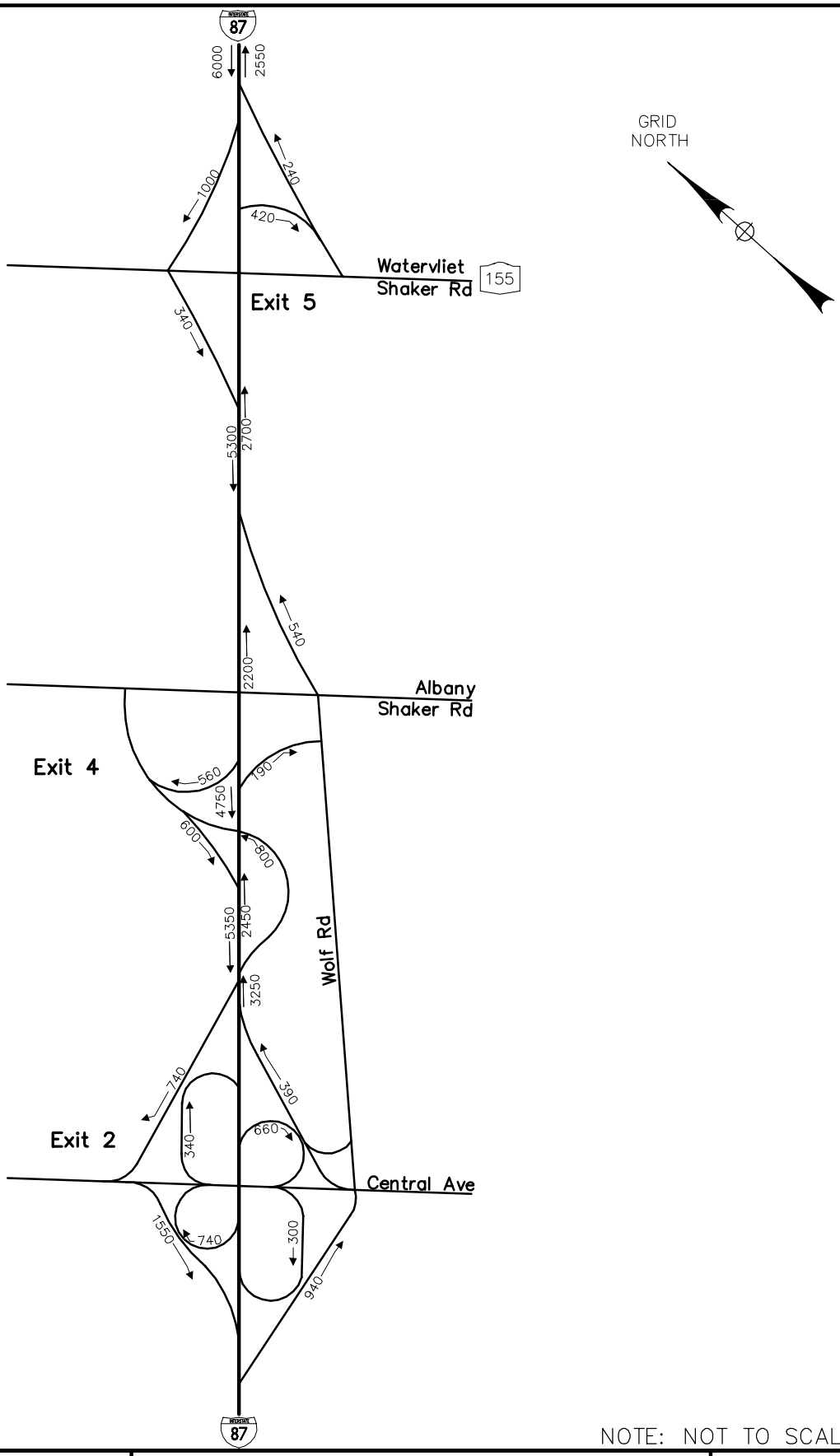
2046 FLYOVER ALTERNATIVE PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4 ACCESS
ACCESS IMPROVEMENTS

FIGURE
F–44

DATE:12/12

Saved: 1/9/2012 5:14:23 PM PLotted: 12/31/2012 8:59:27 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2046 PM FLYOVER.DWG



NOTE: NOT TO SCALE

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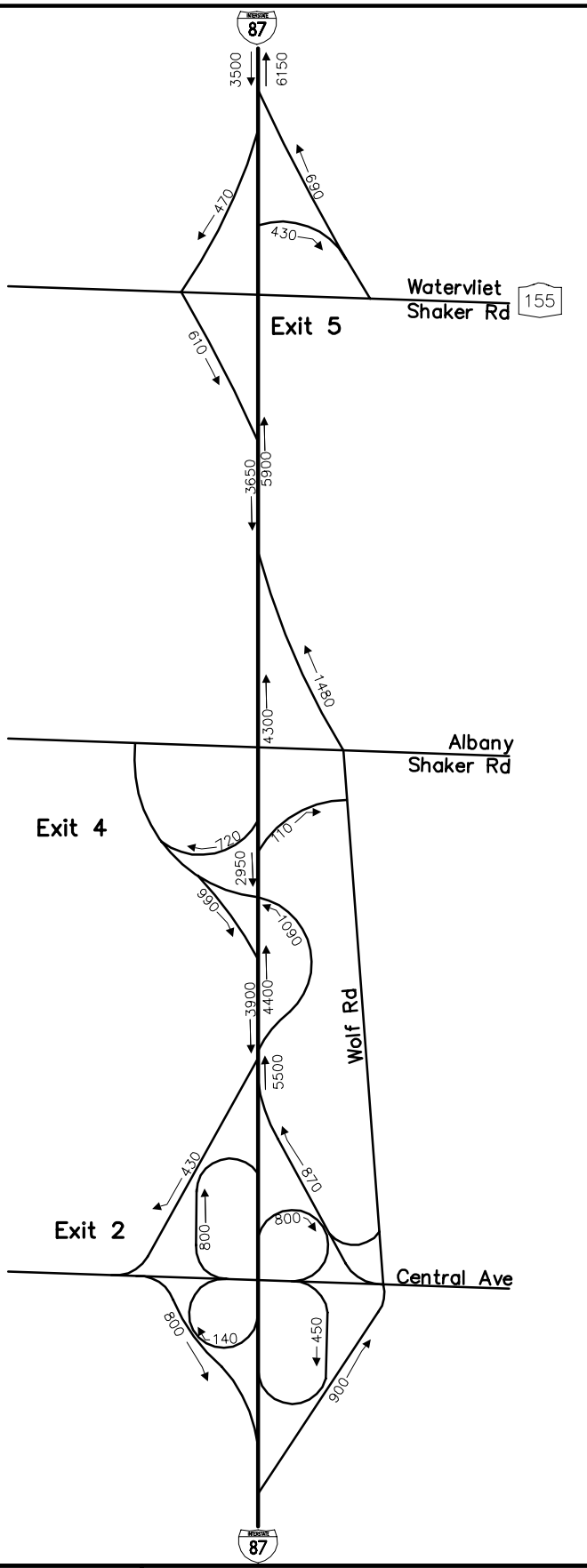
2016 FLYOVER ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–45

DATE: 8/13

Saved: 12/31/2012 11:06:53 AM PLotted: 8/27/2013 11:29:23 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2016 AM FLYOVER HIGHWAY VOL.DWG



GRID NORTH

NOTE: NOT TO SCALE

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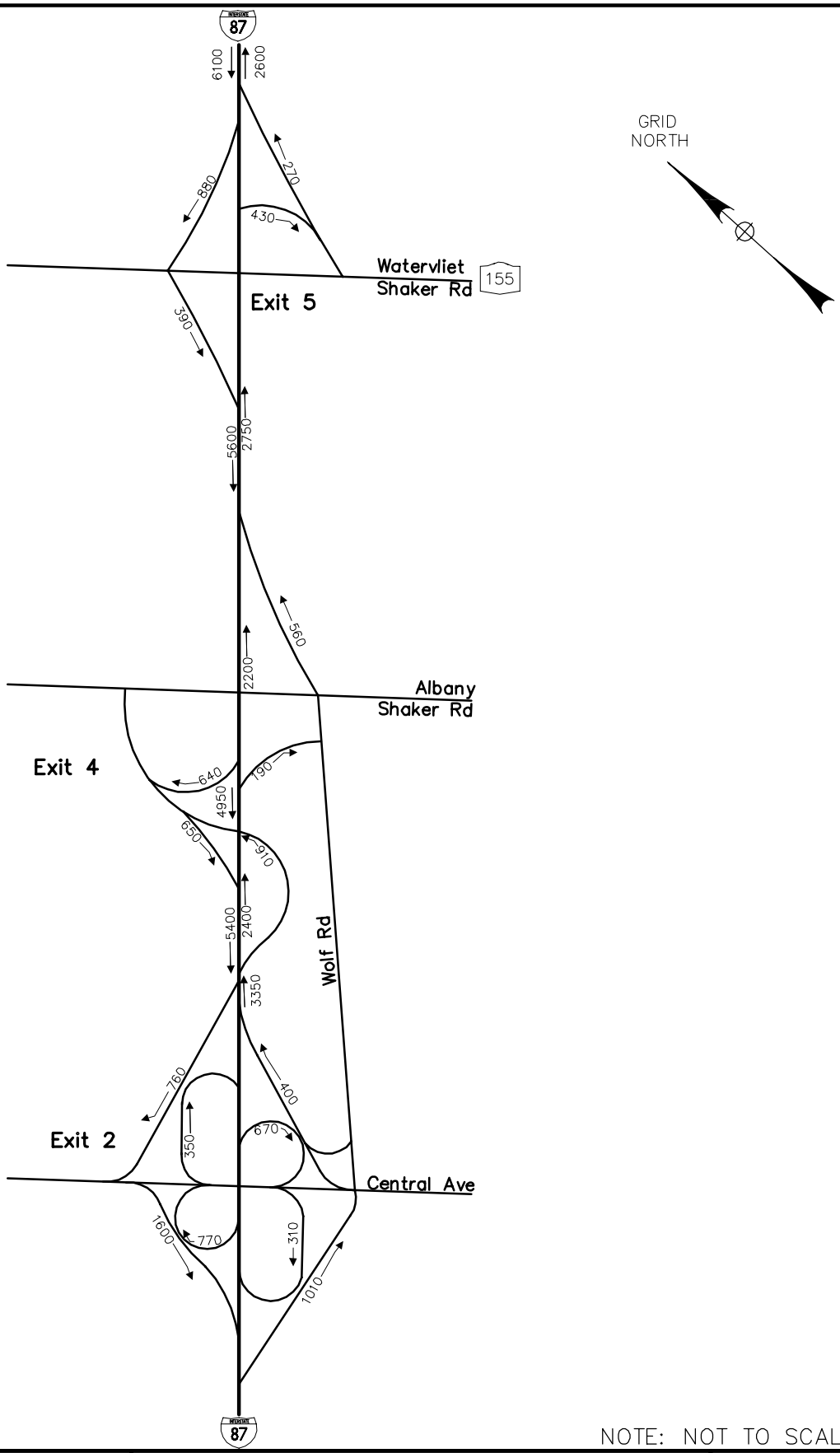
2016 FLYOVER ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–46

DATE: 8/13

Saved: 12/31/2012 11:06:52 AM PLotted: 8/27/2013 11:31:07 AM User: Gray, Timmalyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2016 PM FLYOVER HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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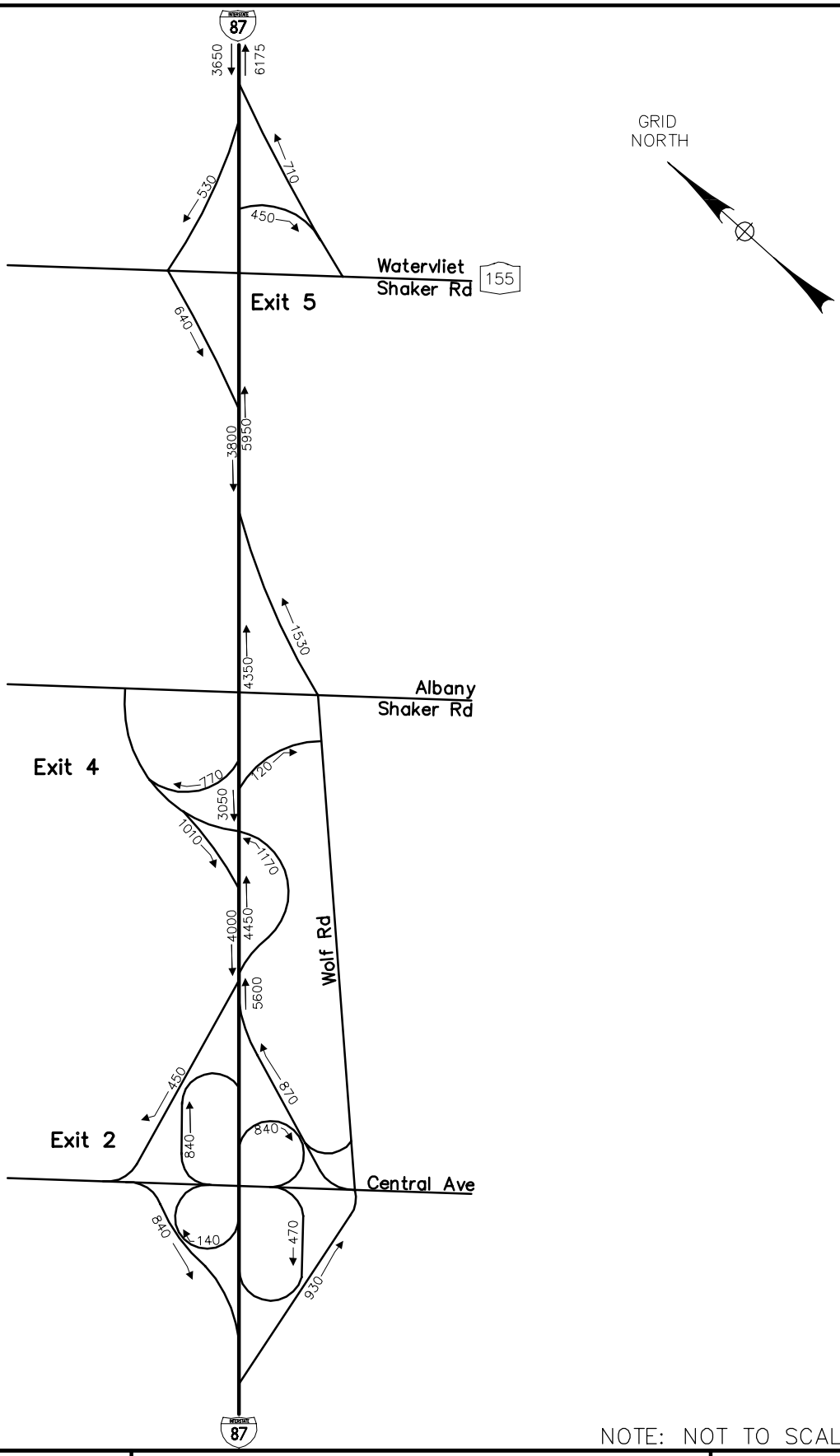
2026 FLYOVER ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–47

DATE: 8/13

Saved: 12/31/2012 11:06:50 AM PLotted: 8/27/2013 11:32:56 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2026 AM FLYOVER HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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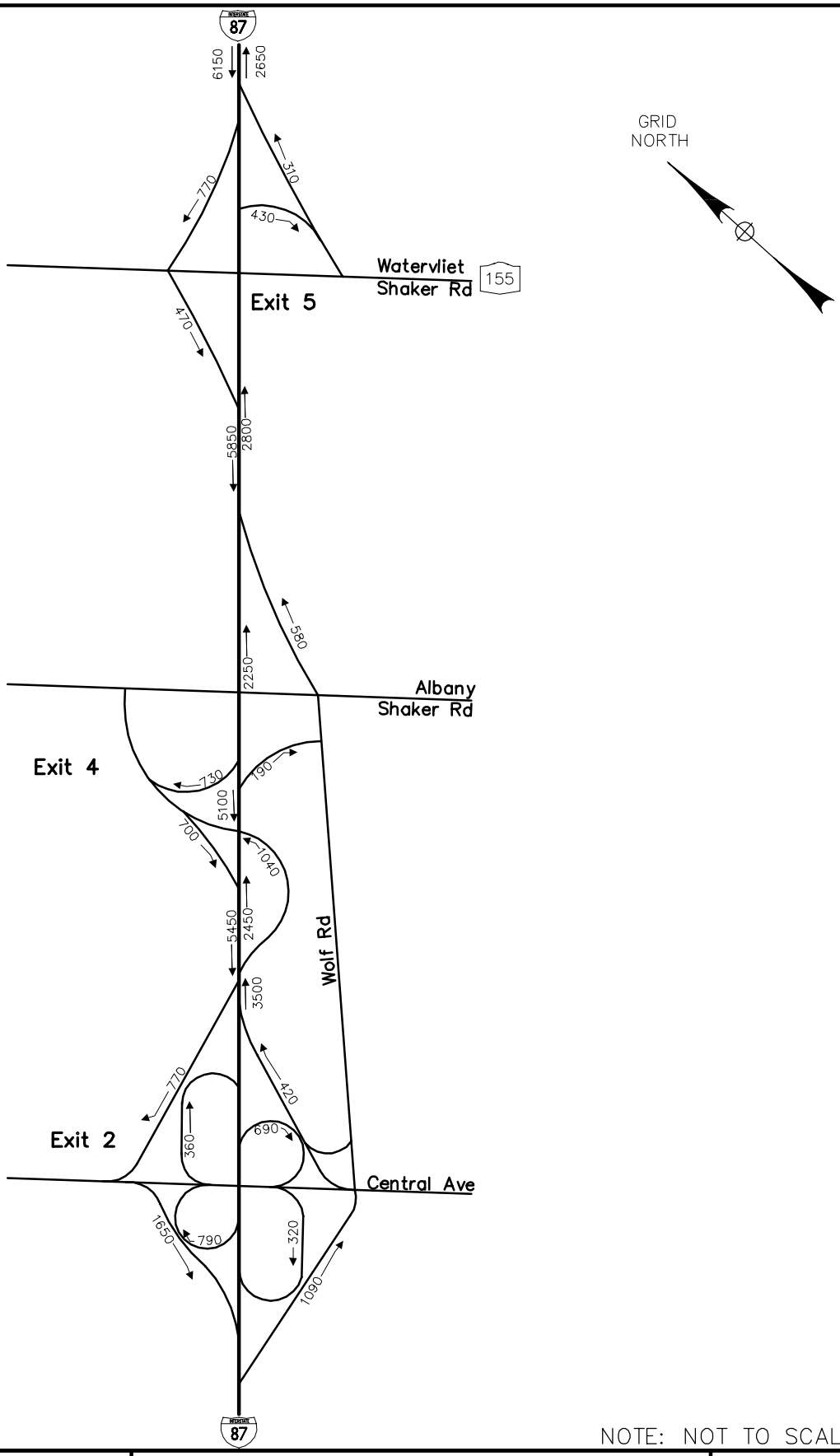
2026 FLYOVER ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–48

DATE: 8/13

Saved: 12/31/2012 11:06:49 AM PLotted: 8/27/2013 11:34:34 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2026 PM FLYOVER HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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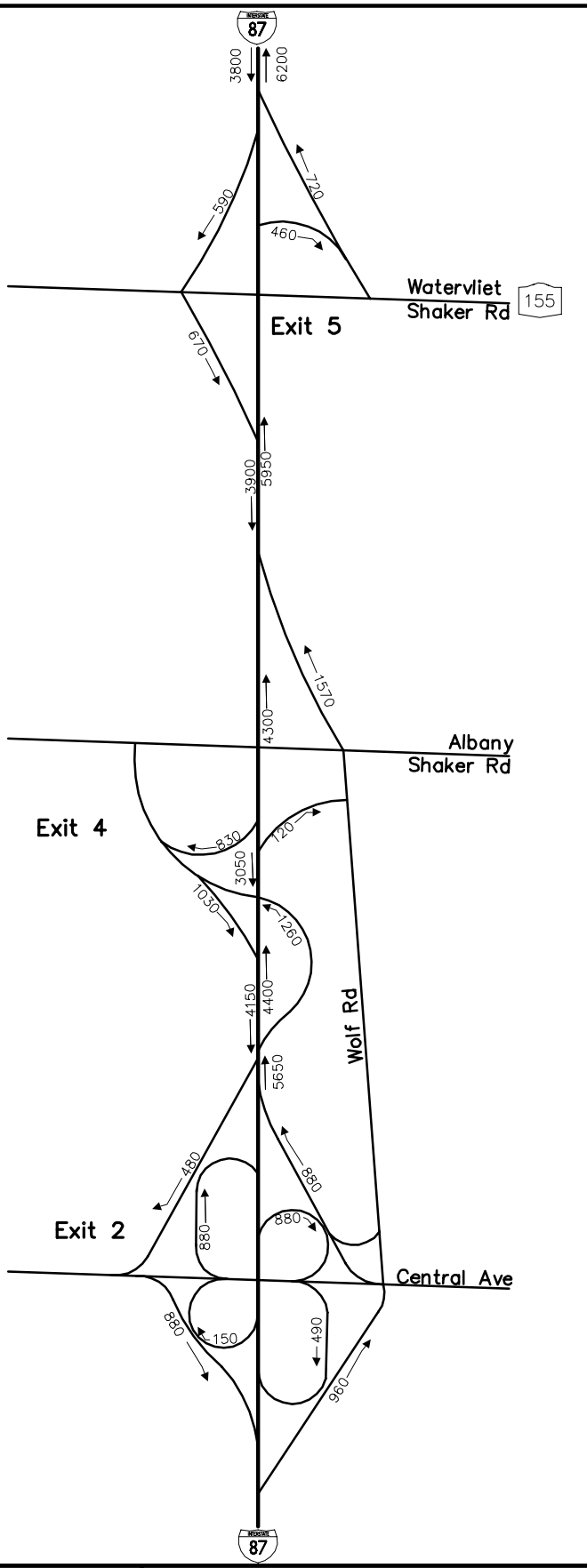
2036 FLYOVER ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I–87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F–49

DATE: 8/13

Saved: 12/31/2012 11:06:47 AM PLotted: 8/27/2013 11:35:48 AM User: Gray, Timmolyn
FILE: U:\9456\ACAD\31\ACAD\2008–2009 ANALYSIS\DEIS FIGURES 2012\2036 AM FLYOVER HIGHWAY VOL.DWG



GRID NORTH

NOTE: NOT TO SCALE

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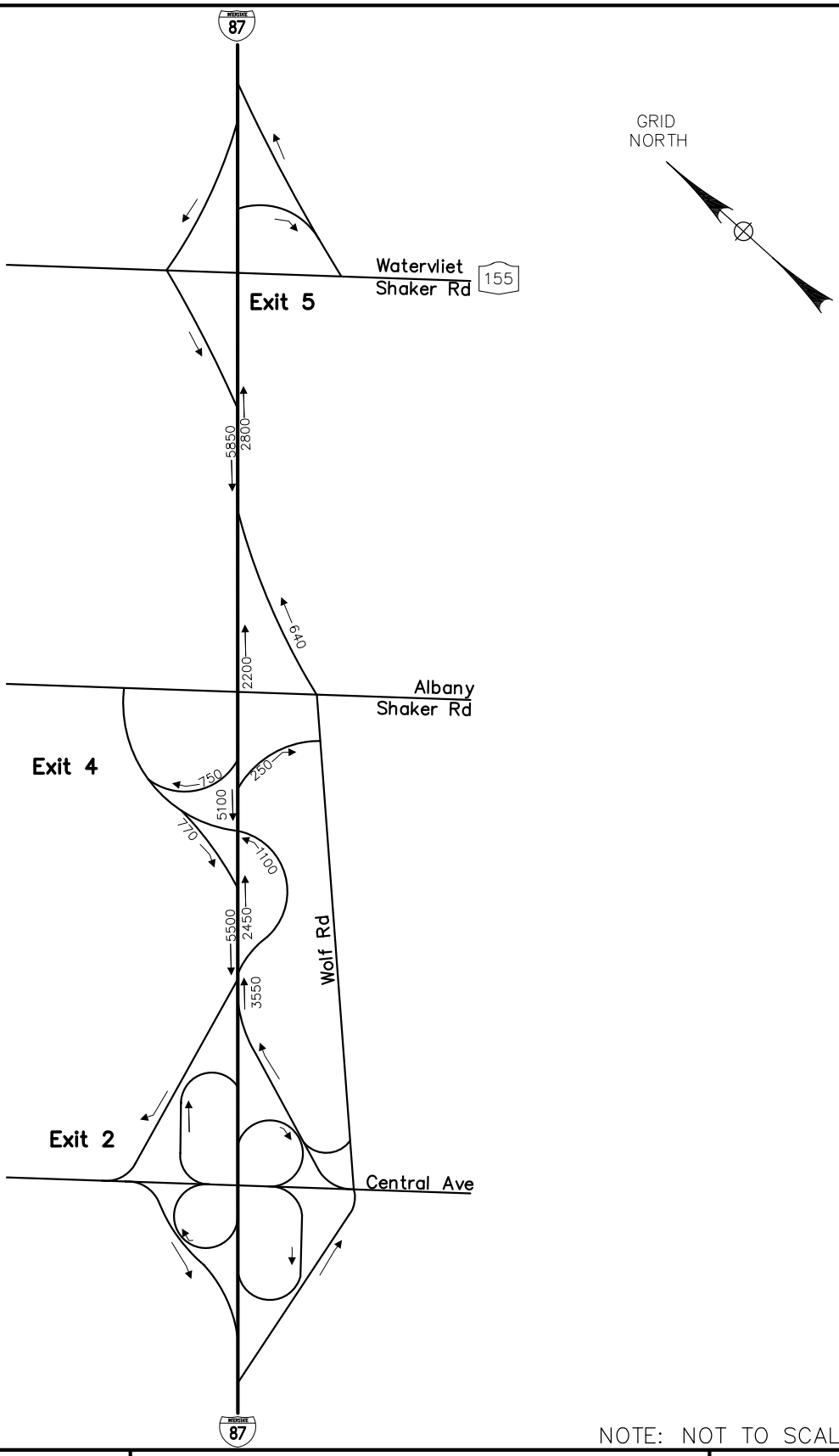
2036 FLYOVER ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-50

DATE: 8/13

Saved: 12/31/2012 11:06:41 AM PLotted: 8/27/2013 11:36:57 AM User: Gray, Timmalyn
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2036 PM FLYOVER HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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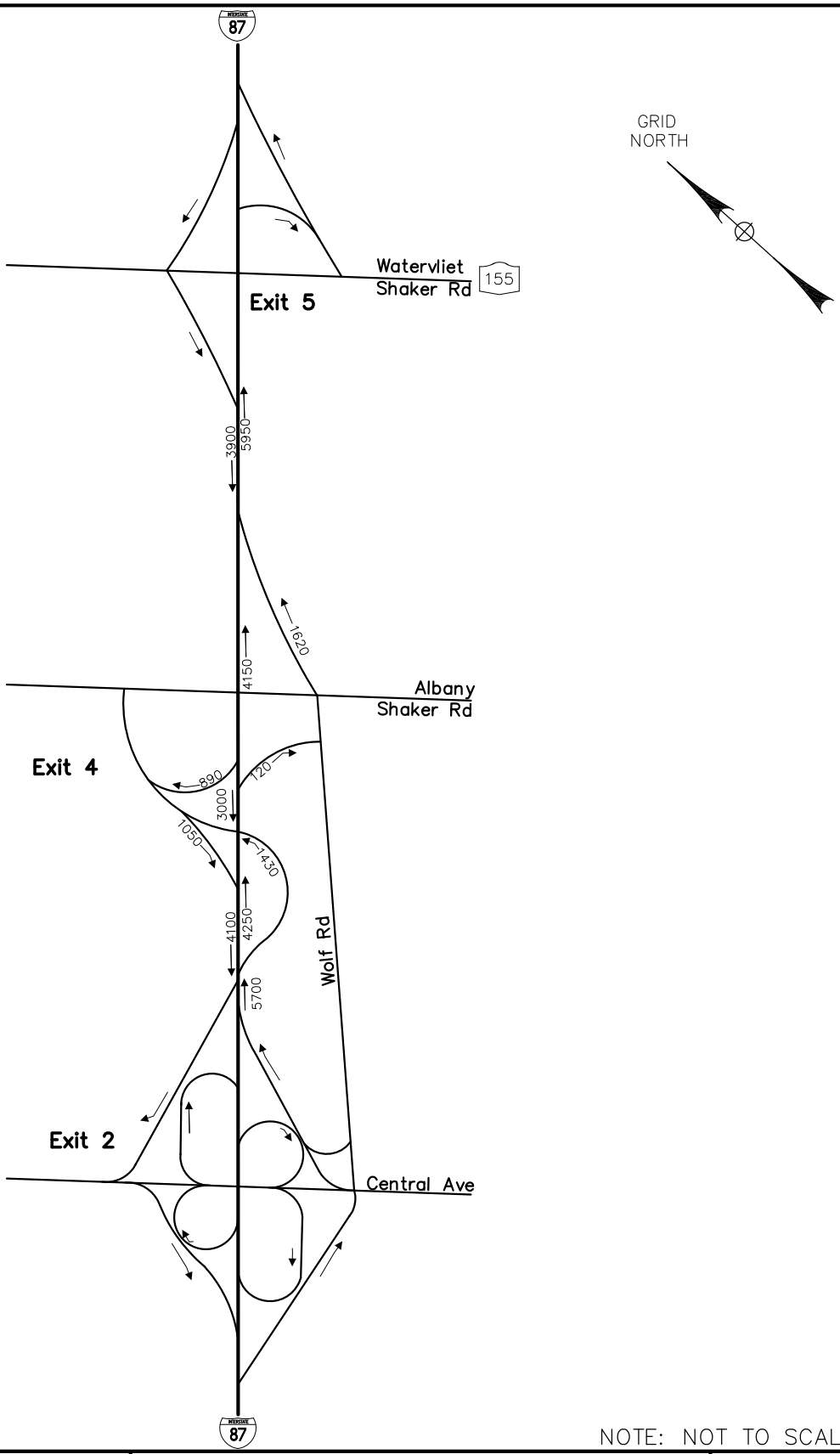
2046 FLYOVER ALTERNATIVE HIGHWAY AM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-51

DATE: 12/12

Saved: 2/24/2012 9:18:07 AM Plotted: 12/31/2012 9:21:55 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2046 AM FLYOVER HIGHWAY VOL.DWG



NOTE: NOT TO SCALE

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2046 FLYOVER ALTERNATIVE HIGHWAY PM PEAK HOUR TRAFFIC VOLUMES

INTERSTATE 87 (I-87) EXIT 3 / 4
ACCESS IMPROVEMENTS

FIGURE
F-52

DATE: 12/12

Saved: 2/24/2012 9:18:04 AM Plotted: 12/31/2012 9:23:49 AM User: Kinley, James
FILE: U:\9456\ACAD\31\ACAD\2008-2009 ANALYSIS\DEIS FIGURES 2012\2046 PM FLYOVER HIGHWAY VOL.DWG

ATTACHMENT B
TRAFFIC COUNT DATA

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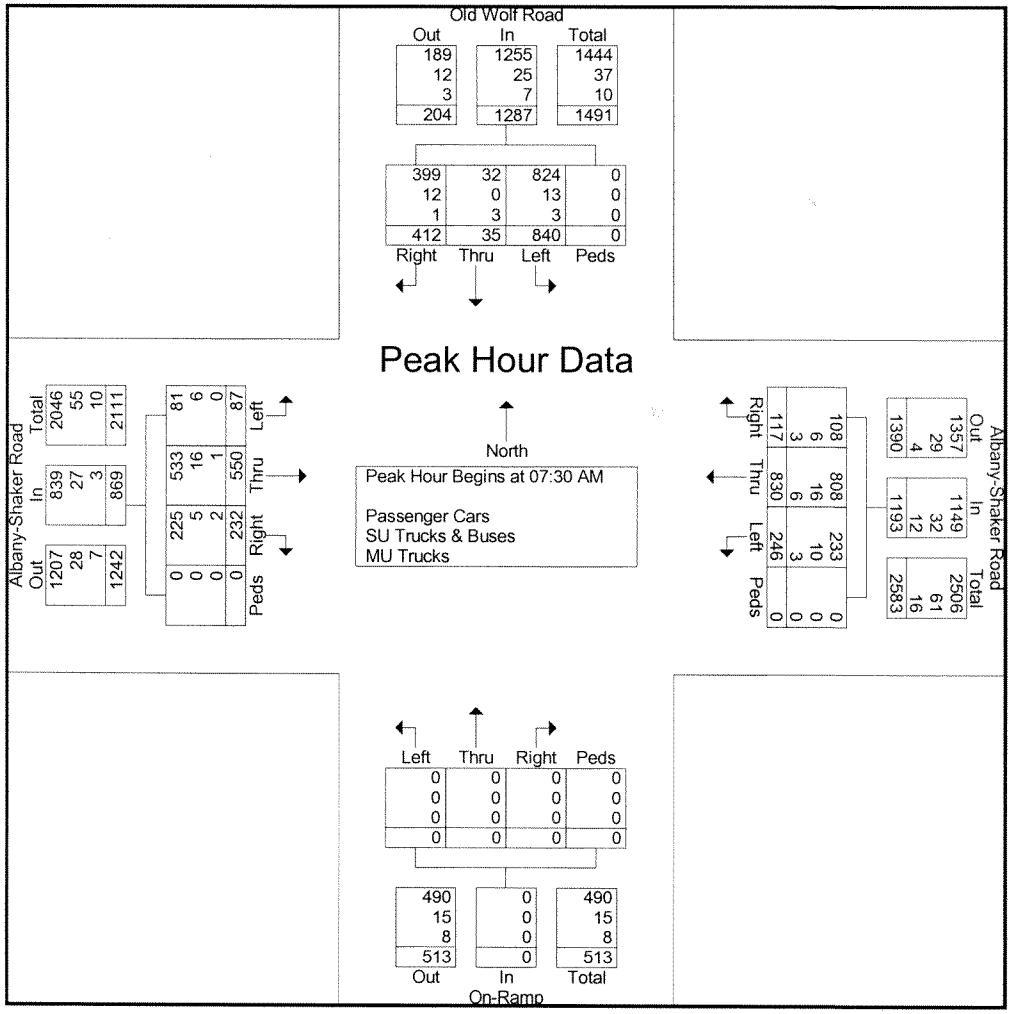
Exit 3/Exit 4
Old Wolf Road/Albany-Shaker Road
AM
7 to 9

File Name : Albany Shaker Road & Old Wolf Road AM
Site Code : 01270901
Start Date : 1/27/2009
Page No : 4



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Exit 3/Exit 4
Old Wolf Road/Albany-Shaker Road
AM
7 to 9

File Name : Albany Shaker Road & Old Wolf Road AM
Site Code : 01270901
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Old Wolf Road Southbound					Albany-Shaker Road Westbound					On-Ramp Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	83	11	138	0	232	21	100	33	2	156	0	0	0	0	0	38	104	16	0	158	546
07:15 AM	80	6	187	0	273	24	151	51	0	226	0	0	0	0	0	46	114	22	0	182	681
07:30 AM	104	7	198	0	309	37	195	64	0	296	0	0	0	0	0	62	133	20	0	215	820
07:45 AM	121	12	219	0	352	24	236	56	0	316	0	0	0	0	0	51	135	28	0	214	882
Total	388	36	742	0	1166	106	682	204	2	994	0	0	0	0	0	197	486	86	0	769	2929
08:00 AM	86	9	194	0	289	23	199	56	0	278	0	0	0	0	0	58	161	24	0	243	810
08:15 AM	101	7	229	0	337	33	200	70	0	303	0	0	0	0	0	61	121	15	0	197	837
08:30 AM	76	11	212	1	300	35	154	60	0	249	0	0	0	0	0	61	157	17	0	235	784
08:45 AM	81	10	272	0	363	25	150	50	0	225	0	0	0	0	0	65	97	14	0	176	764
Total	344	37	907	1	1289	116	703	236	0	1055	0	0	0	0	0	245	536	70	0	851	3195
Grand Total	732	73	1649	1	2455	222	1385	440	2	2049	0	0	0	0	0	442	1022	156	0	1620	6124
Apprch %	29.8	3	67.2	0		10.8	67.6	21.5	0.1		0	0	0	0		27.3	63.1	9.6	0		
Total %	12	1.2	26.9	0	40.1	3.6	22.6	7.2	0	33.5	0	0	0	0	0	7.2	16.7	2.5	0	26.5	
Passenger Cars																					
% Passenger Cars	97	89	98.2	100	97.6	91.9	96.7	95.2	100	95.9	0	0	0	0	0	96.6	97	89.7	0	96.2	96.6
SU Trucks & Buses	21	4	24	0	49	11	37	17	0	65	0	0	0	0	0	10	28	16	0	54	168
% SU Trucks & Buses	2.9	5.5	1.5	0	2	5	2.7	3.9	0	3.2	0	0	0	0	0	2.3	2.7	10.3	0	3.3	2.7
MU Trucks	1	4	6	0	11	7	9	4	0	20	0	0	0	0	0	5	3	0	0	8	39
% MU Trucks	0.1	5.5	0.4	0	0.4	3.2	0.6	0.9	0	1	0	0	0	0	0	1.1	0.3	0	0	0.5	0.6

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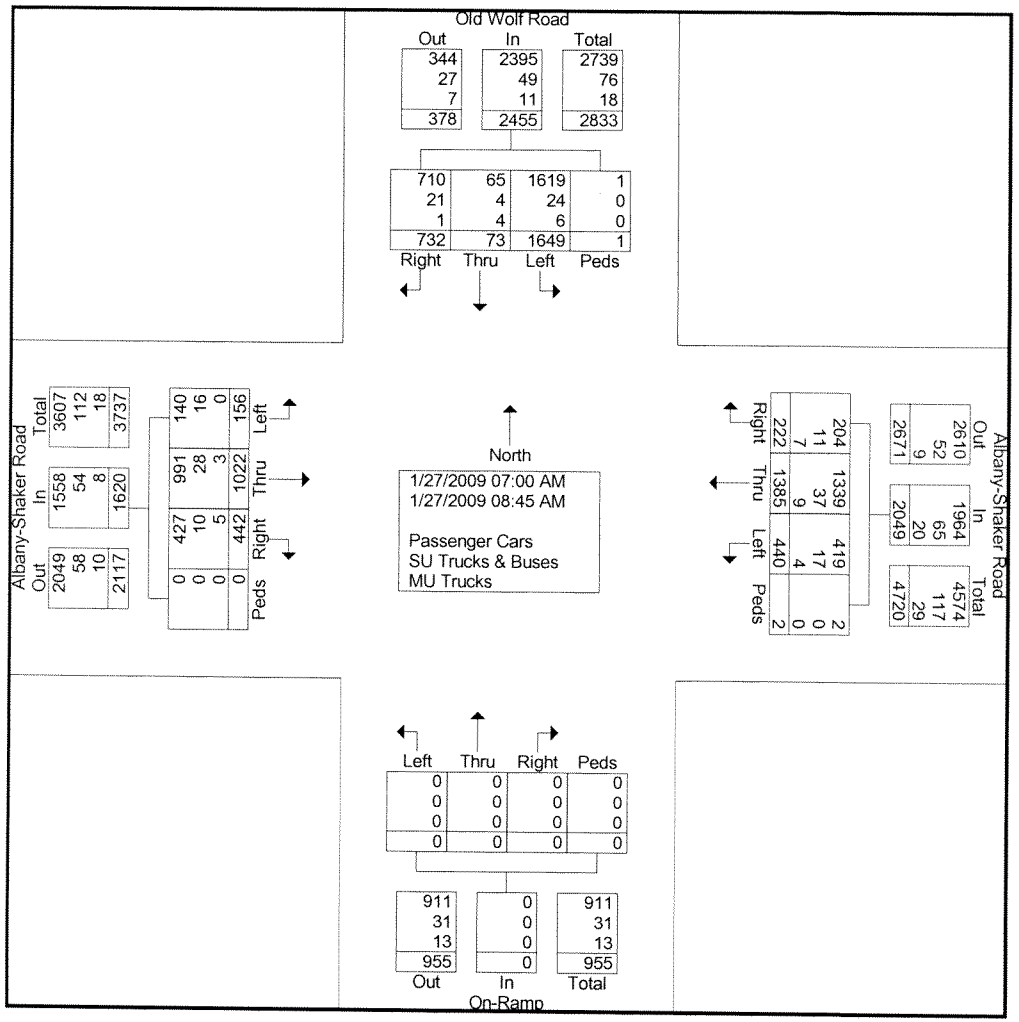
Exit 3/Exit 4
Old Wolf Road/Albany-Shaker Road
AM
7 to 9

File Name : Albany Shaker Road & Old Wolf Road AM
Site Code : 01270901
Start Date : 1/27/2009
Page No : 2



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Exit 3/Exit 4
Old Wolf Road/Albany-Shaker Road
AM
7 to 9

File Name : Albany Shaker Road & Old Wolf Road AM
Site Code : 01270901
Start Date : 1/27/2009

	Old Wolf Road Southbound					Albany-Shaker Road Westbound					On-Ramp Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	104	7	198	0	309	**37**	195	64								**62**	133	20			
07:45 AM	**121**	**12**	219	0	**352**	24	**236**	56	0	**316**	0	0	0	0	0	51	135	**28**	0	214	**882**
08:00 AM	86	9	194	0	289	23	199	56	0	278	0	0	0	0	0	58	**161**	24	0	**243**	810
08:15 AM	101	7	**229**	0	337	33	200	**70**	0	303	0	0	0	0	0	61	121	15	0	197	837
Total Volume	412	35	840	0	1287	117	830	246	0	1193	0	0	0	0	0	232	550	87	0	869	3349
% App. Total	32	2.7	65.3	0		9.8	69.6	20.6	0		0	0	0	0		26.7	63.3	10	0		
PHF	.851	.729	.917	.000	.914	.791	.879	.879	.000	.944	.000	.000	.000	.000	.000	.935	.854	.777	.000	.894	.949
Passenger Cars	399	32	824	0	1255	108	808	233	0	1149	0	0	0	0	0	225	533	81	0	839	3243
% Passenger Cars	96.8	91.4	98.1	0	97.5	92.3	97.3	94.7	0	96.3	0	0	0	0	0	97.0	96.9	93.1	0	96.5	96.8
SU Trucks & Buses	12	0	13	0	25	6	16	10	0	32	0	0	0	0	0	5	16	6	0	27	84
% SU Trucks & Buses	2.9	0	1.5	0	1.9	5.1	1.9	4.1	0	2.7	0	0	0	0	0	2.2	2.9	6.9	0	3.1	2.5
MU Trucks	1	3	3	0	7	3	6	3	0	12	0	0	0	0	0	2	1	0	0	3	22
% MU Trucks	0.2	8.6	0.4	0	0.5	2.6	0.7	1.2	0	1.0	0	0	0	0	0	0.9	0.2	0	0	0.3	0.7

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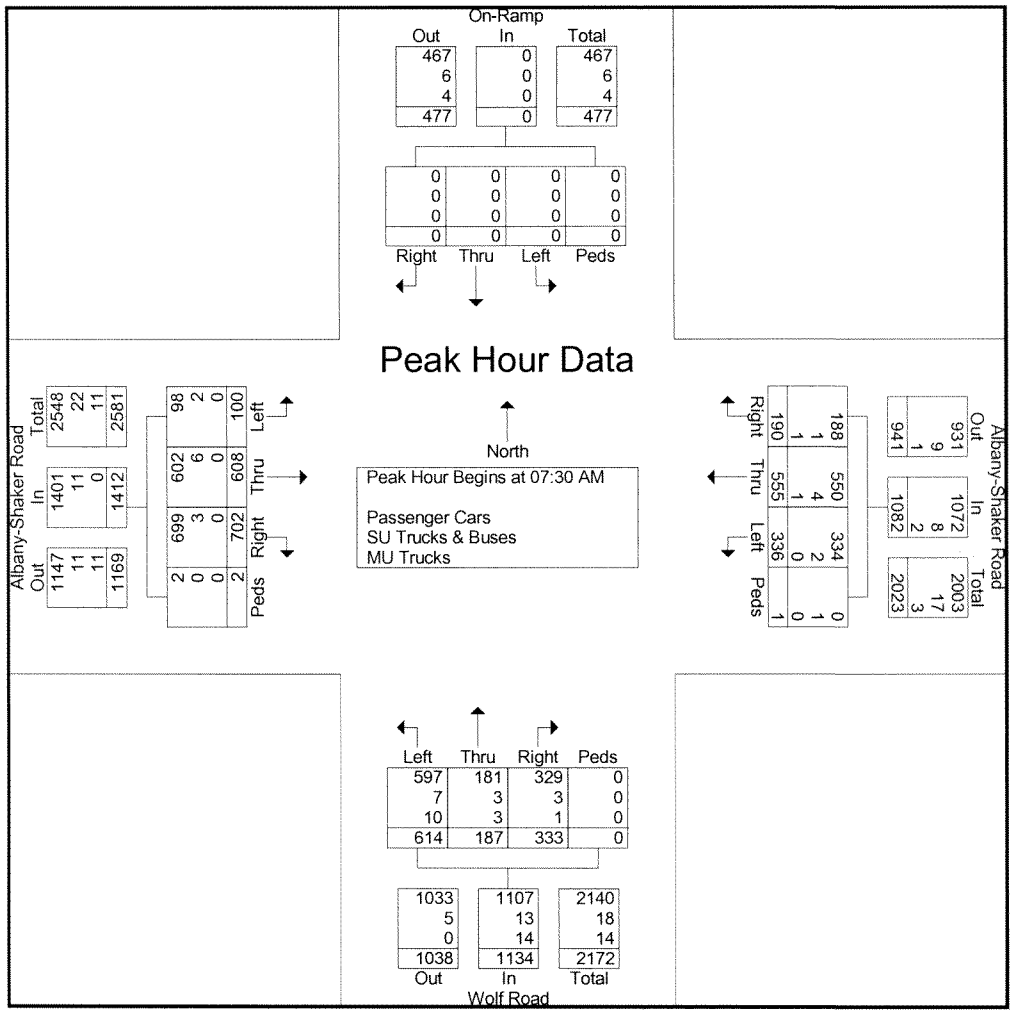
Exit 3/Exit 4
Albany Shaker Road & Wolf Road
AM
7 to 9

File Name : Albany Shaker Road & Wolf Road AM
Site Code : 01270916
Start Date : 1/27/2009
Page No : 4



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Exit 3/Exit 4
Albany Shaker Road & Wolf Road
AM
7 to 9

File Name : Albany Shaker Road & Wolf Road AM
Site Code : 01270916
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	On-Ramp Southbound					Albany-Shaker Road Westbound					Wolf Road Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	1	1	44	89	45	0	178	51	32	107	0	190	115	104	21	0	240	609
07:15 AM	0	0	0	0	0	37	120	62	0	219	48	35	124	0	207	187	138	27	0	352	778
07:30 AM	0	0	0	0	0	52	149	77	0	278	65	45	175	0	285	155	173	28	2	358	921
07:45 AM	0	0	0	0	0	49	121	89	1	260	89	49	160	0	298	159	128	31	0	318	876
Total	0	0	0	1	1	182	479	273	1	935	253	161	566	0	980	616	543	107	2	1268	3184
08:00 AM	0	0	0	0	0	50	145	74	0	269	90	39	147	0	276	191	152	22	0	365	910
08:15 AM	0	0	0	0	0	39	140	96	0	275	89	54	132	0	275	197	155	19	0	371	921
08:30 AM	0	0	0	0	0	44	125	67	0	236	66	52	130	0	248	215	124	21	0	360	844
08:45 AM	0	0	0	0	0	38	70	83	0	191	72	33	111	1	217	212	133	23	0	368	776
Total	0	0	0	0	0	171	480	320	0	971	317	178	520	1	1016	815	564	85	0	1464	3451
Grand Total	0	0	0	1	1	353	959	593	1	1906	570	339	1086	1	1996	1431	1107	192	2	2732	6635
Apprch %	0	0	0	100		18.5	50.3	31.1	0.1		28.6	17	54.4	0.1		52.4	40.5	7	0.1		
Total %	0	0	0	0	0	5.3	14.5	8.9	0	28.7	8.6	5.1	16.4	0	30.1	21.6	16.7	2.9	0	41.2	
Passenger Cars																					
% Passenger Cars	0	0	0	100	100	98.9	98.2	99	0	98.5	98.8	97.6	97	100	97.6	99.4	98.8	99	100	99.1	98.5
SU Trucks & Buses	0	0	0	0	0	2	15	5	1	23	5	5	17	0	27	9	9	2	0	20	70
% SU Trucks & Buses	0	0	0	0	0	0.6	1.6	0.8	100	1.2	0.9	1.5	1.6	0	1.4	0.6	0.8	1	0	0.7	1.1
MU Trucks	0	0	0	0	0	2	2	1	0	5	2	3	16	0	21	0	4	0	0	4	30
% MU Trucks	0	0	0	0	0	0.6	0.2	0.2	0	0.3	0.4	0.9	1.5	0	1.1	0	0.4	0	0	0.1	0.5

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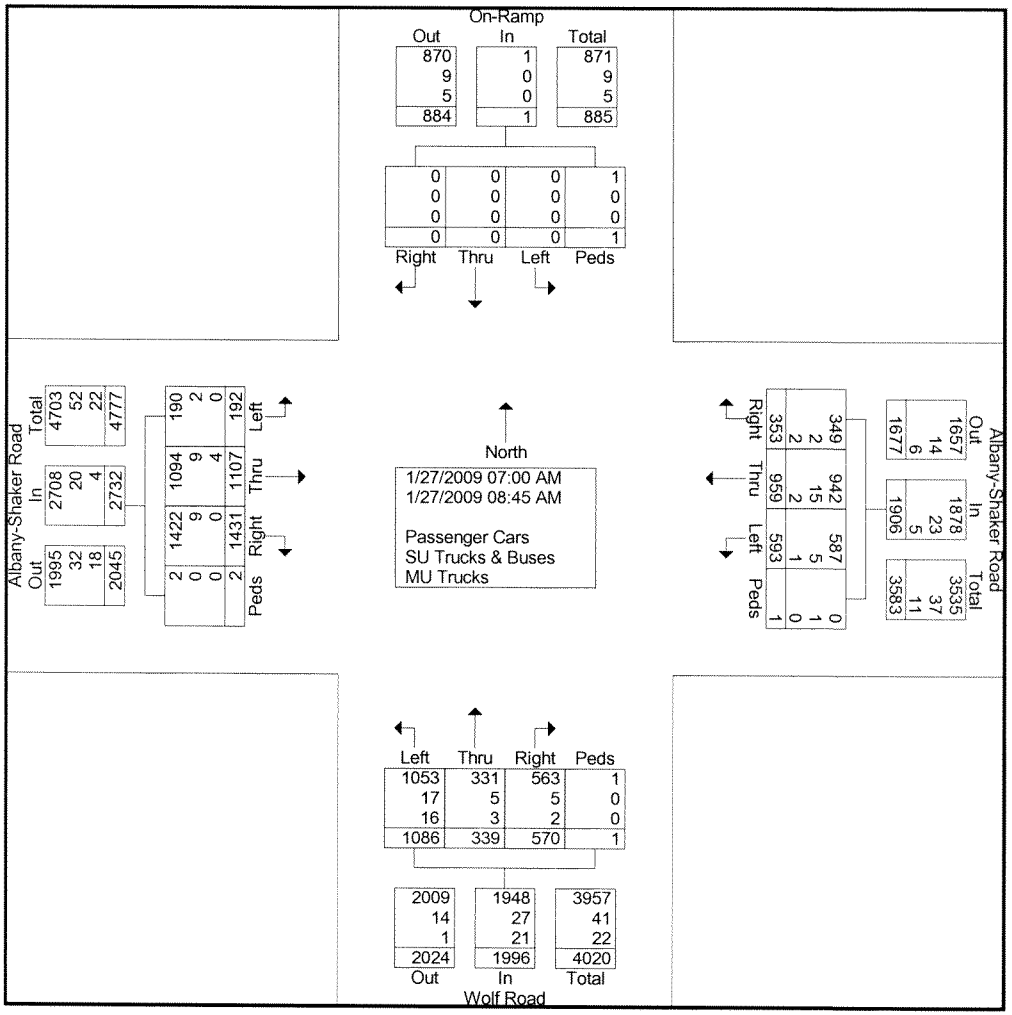
Exit 3/Exit 4
Albany Shaker Road & Wolf Road
AM
7 to 9

File Name : Albany Shaker Road & Wolf Road AM
Site Code : 01270916
Start Date : 1/27/2009
Page No : 2



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Exit 3/Exit 4
Albany Shaker Road & Wolf Road
AM
7 to 9

File Name : Albany Shaker Road & Wolf Road AM
Site Code : 01270916
Start Date : 1/27/2009
Page No : 3

	On-Ramp Southbound					Albany-Shaker Road Westbound					Wolf Road Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	**52**	**149**			**278**		45	**175**				**173**	28	**2**		**921**
07:45 AM	0	0	0	0	0	49	121	89	**1**	260	89	49	160	0	**298**	159	128	**31**	0	318	876
08:00 AM	0	0	0	0	0	50	145	74	0	269	**90**	39	147	0	276	191	152	22	0	365	910
08:15 AM	0	0	0	0	0	39	140	**96**	0	275	89	**54**	132	0	275	**197**	155	19	0	**371**	921
Total Volume	0	0	0	0	0	190	555	336	1	1082	333	187	614	0	1134	702	608	100	2	1412	3628
% App. Total	0	0	0	0		17.6	51.3	31.1	0.1		29.4	16.5	54.1	0		49.7	43.1	7.1	0.1		
PHF	.000	.000	.000	.000	.000	.913	.931	.875	.250	.973	.925	.866	.877	.000	.951	.891	.879	.806	.250	.951	.985
Passenger Cars	0	0	0	0	0	188	550	334	0	1072	329	181	597	0	1107	699	602	98	2	1401	3580
% Passenger Cars	0	0	0	0	0	98.9	99.1	99.4	0	99.1	98.8	96.8	97.2	0	97.6	99.6	99.0	98.0	100	99.2	98.7
SU Trucks & Buses	0	0	0	0	0	1	4	2	1	8	3	3	7	0	13	3	6	2	0	11	32
% SU Trucks & Buses	0	0	0	0	0	0.5	0.7	0.6	100	0.7	0.9	1.6	1.1	0	1.1	0.4	1.0	2.0	0	0.8	0.9
MU Trucks	0	0	0	0	0	1	1	0	0	2	1	3	10	0	14	0	0	0	0	0	16
% MU Trucks	0	0	0	0	0	0.5	0.2	0	0	0.2	0.3	1.6	1.6	0	1.2	0	0	0	0	0	0.4

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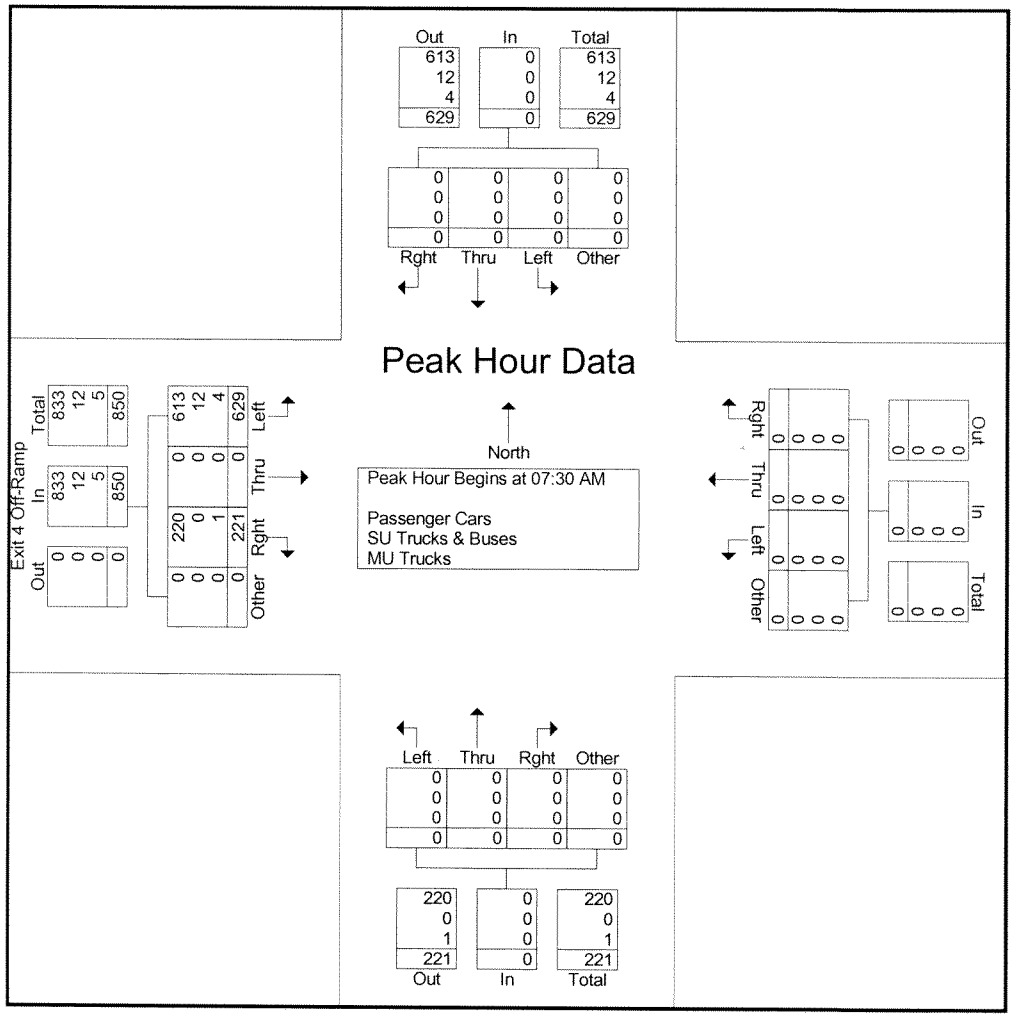
Exit 3/Exit 4
Exit 4 NB Off-Ramp
AM
7-9

File Name : Exit 4 NB Off-Ramp
Site Code : 00000000
Start Date : 1/27/2009
Page No : 4



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Exit 4 NB Off-Ramp
AM
7-9

File Name : Exit 4 NB Off-Ramp
Site Code : 00000000
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Southbound					Westbound					Northbound					Exit 4 Off-Ramp Eastbound					
Start Time	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	71	0	95	95
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	94	0	122	122
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	150	0	184	184
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	194	0	260	260
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	152	0	509	0	661	661
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	0	142	0	200	200
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0	143	0	206	206
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	0	124	0	183	183
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0	124	1	181	181
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236	0	533	1	770	770
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	388	0	1042	1	1431	1431
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		27.1	0	72.8	0.1		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27.1	0	72.8	0.1	100	
Passenger Cars																					
% Passenger Cars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99.2	0	97.5	100	98	98
SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	19	0	21	21
% SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	1.8	0	1.5	1.5
MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	7	0	8	8
% MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0.7	0	0.6	0.6

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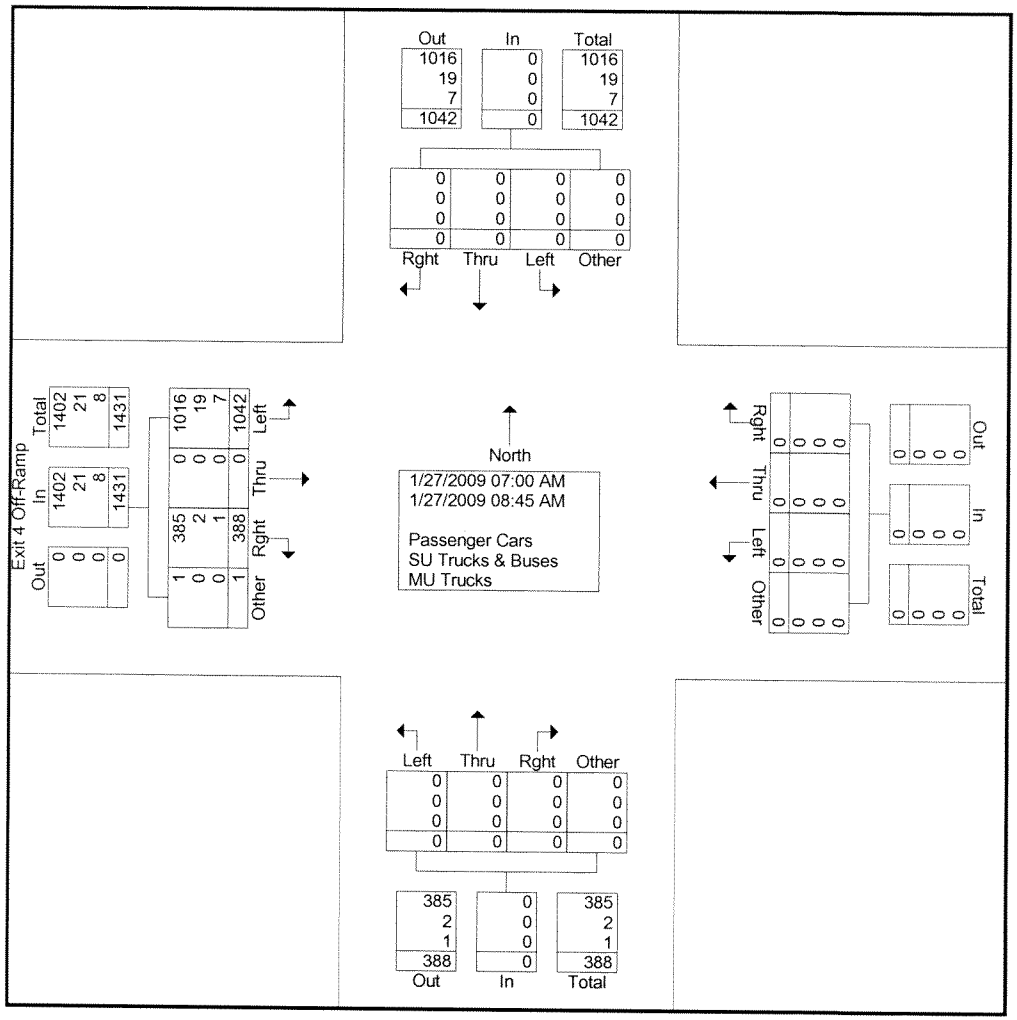
Exit 3/Exit 4
Exit 4 NB Off-Ramp
AM
7-9

File Name : Exit 4 NB Off-Ramp
Site Code : 00000000
Start Date : 1/27/2009
Page No : 2



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Exit 3/Exit 4
Exit 4 NB Off-Ramp
AM
7-9

File Name : Exit 4 NB Off-Ramp
Site Code : 00000000
Start Date : 1/27/2009
Page No : 3

	Southbound					Westbound					Northbound					Exit 4 Off-Ramp Eastbound					
Start Time	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	150	0	184	184
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**66**		**194**		**260**	**260**
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	0	142	0	200	200
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0	143	0	206	206
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	221	0	629	0	850	850
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		26	0	74	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.837	.000	.811	.000	.817	.817
Passenger Cars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220	0	613	0	833	833
% Passenger Cars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99.5	0	97.5	0	98.0	98.0
SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	12	12
% SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	0	1.4	1.4
MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	5	5
% MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.6	0	0.6	0.6

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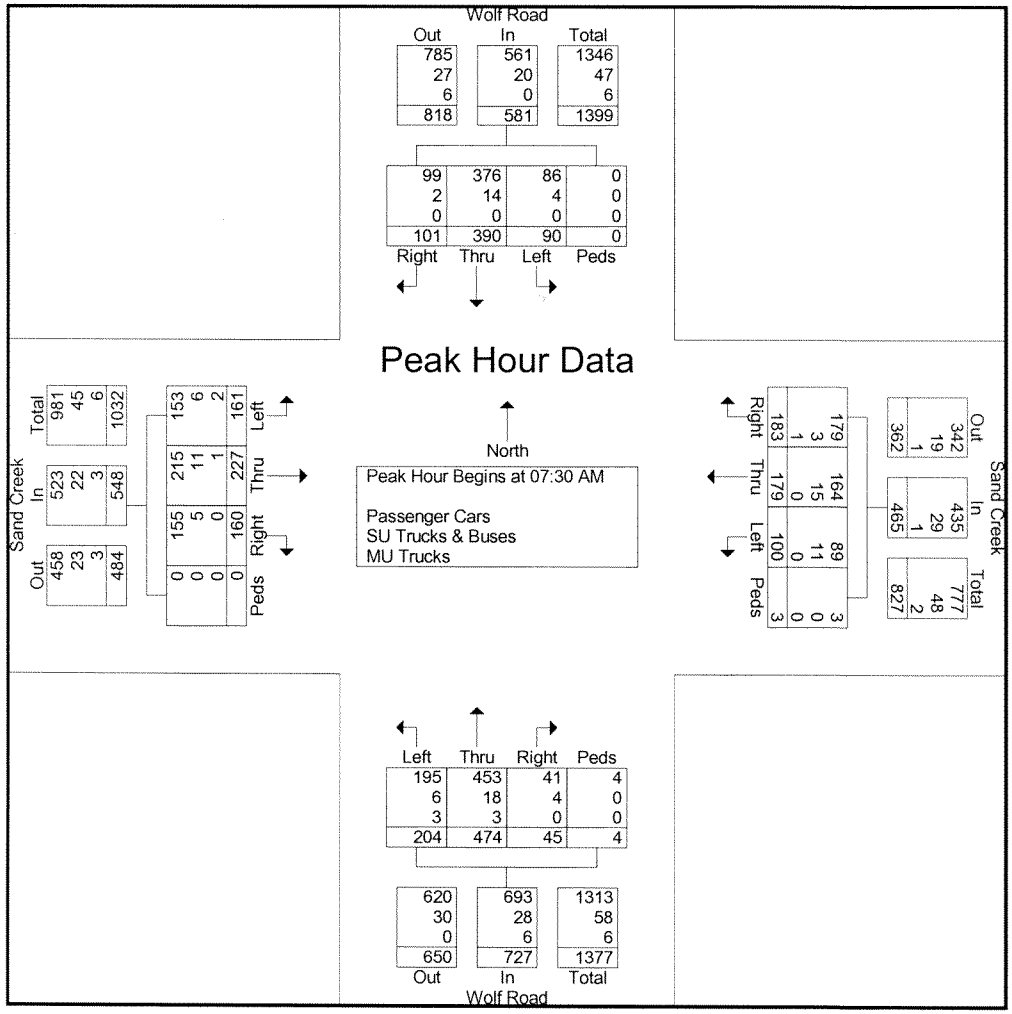
Exit 3/Exit 4
Sand Creek & Wolf Road
AM
7 to 9

File Name : Sand Creek & Wolf Road TOTAL AM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 4



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Exit 3/Exit 4
Sand Creek & Wolf Road
AM
7 to 9

File Name : Sand Creek & Wolf Road TOTAL AM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Sand Creek Westbound					Wolf Road Northbound					Sand Creek Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	14	66	18	1	99	20	23	11	1	55	4	44	21	0	69	35	53	24	0	112	335
07:15 AM	13	94	23	0	130	35	36	26	3	100	15	85	40	2	142	41	34	32	0	107	479
07:30 AM	25	103	31	0	159	45	27	25	0	97	18	87	52	0	157	48	69	32	0	149	562
07:45 AM	24	99	16	0	139	48	70	31	2	151	4	133	57	4	198	41	47	38	0	126	614
Total	76	362	88	1	527	148	156	93	6	403	41	349	170	6	566	165	203	126	0	494	1990
08:00 AM	22	93	27	0	142	49	45	25	0	119	14	118	44	0	176	50	49	38	0	137	574
08:15 AM	30	95	16	0	141	41	37	19	1	98	9	136	51	0	196	21	62	53	0	136	571
08:30 AM	26	90	14	0	130	29	39	19	0	87	11	123	42	0	176	36	60	38	0	134	527
08:45 AM	28	91	14	1	134	30	42	15	1	88	9	135	37	2	183	40	43	44	0	127	532
Total	106	369	71	1	547	149	163	78	2	392	43	512	174	2	731	147	214	173	0	534	2204
Grand Total	182	731	159	2	1074	297	319	171	8	795	84	861	344	8	1297	312	417	299	0	1028	4194
Apprch %	16.9	68.1	14.8	0.2		37.4	40.1	21.5	1		6.5	66.4	26.5	0.6		30.4	40.6	29.1	0		
Total %	4.3	17.4	3.8	0	25.6	7.1	7.6	4.1	0.2	19	2	20.5	8.2	0.2	30.9	7.4	9.9	7.1	0	24.5	
Passenger Cars																					
% Passenger Cars	97.8	96.3	96.9	100	96.6	98	91.5	87.7	100	93.2	88.1	95.5	96.2	100	95.2	97.8	91.8	97	0	95.1	95.2
SU Trucks & Buses	4	27	5	0	36	3	26	21	0	50	9	35	10	0	54	7	33	7	0	47	187
% SU Trucks & Buses	2.2	3.7	3.1	0	3.4	1	8.2	12.3	0	6.3	10.7	4.1	2.9	0	4.2	2.2	7.9	2.3	0	4.6	4.5
MU Trucks	0	0	0	0	0	3	1	0	0	4	1	4	3	0	8	0	1	2	0	3	15
% MU Trucks	0	0	0	0	0	1	0.3	0	0	0.5	1.2	0.5	0.9	0	0.6	0	0.2	0.7	0	0.3	0.4

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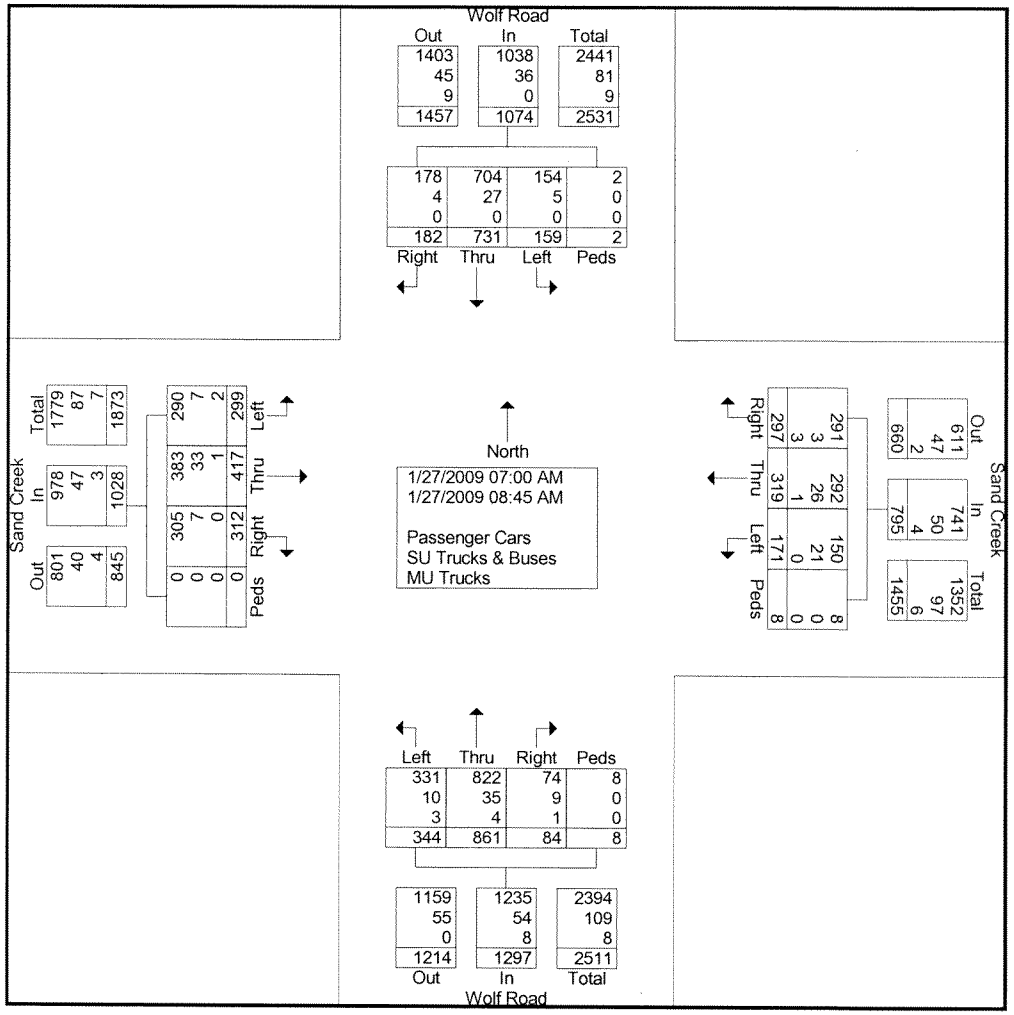
Exit 3/Exit 4
Sand Creek & Wolf Road
AM
7 to 9

File Name : Sand Creek & Wolf Road TOTAL AM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 2



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Exit 3/Exit 4
Sand Creek & Wolf Road
AM
7 to 9

File Name : Sand Creek & Wolf Road TOTAL AM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 3

	Wolf Road Southbound					Sand Creek Westbound					Wolf Road Northbound					Sand Creek Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	25	**103**	**31**		**159**						**18**						**69**			**149**	
07:45 AM	24	99	16	0	139	48	**70**	**31**	**2**	**151**	4	133	**57**	**4**	**198**	41	47	38	0	126	**614**
08:00 AM	22	93	27	0	142	**49**	45	25	0	119	14	118	44	0	176	**50**	49	38	0	137	574
08:15 AM	**30**	95	16	0	141	41	37	19	1	98	9	**136**	51	0	196	21	62	**53**	0	136	571
Total Volume	101	390	90	0	581	183	179	100	3	465	45	474	204	4	727	160	227	161	0	548	2321
% App. Total	17.4	67.1	15.5	0		39.4	38.5	21.5	0.6		6.2	65.2	28.1	0.6		29.2	41.4	29.4	0		
PHF	.842	.947	.726	.000	.914	.934	.639	.806	.375	.770	.625	.871	.895	.250	.918	.800	.822	.759	.000	.919	.945
Passenger Cars	99	376	86	0	561	179	164	89	3	435	41	453	195	4	693	155	215	153	0	523	2212
% Passenger Cars	98.0	96.4	95.6	0	96.6	97.8	91.6	89.0	100	93.5	91.1	95.6	95.6	100	95.3	96.9	94.7	95.0	0	95.4	95.3
SU Trucks & Buses	2	14	4	0	20	3	15	11	0	29	4	18	6	0	28	5	11	6	0	22	99
% SU Trucks & Buses	2.0	3.6	4.4	0	3.4	1.6	8.4	11.0	0	6.2	8.9	3.8	2.9	0	3.9	3.1	4.8	3.7	0	4.0	4.3
MU Trucks	0	0	0	0	0	1	0	0	0	1	0	3	3	0	6	0	1	2	0	3	10
% MU Trucks	0	0	0	0	0	0.5	0	0	0	0.2	0	0.6	1.5	0	0.8	0	0.4	1.2	0	0.5	0.4

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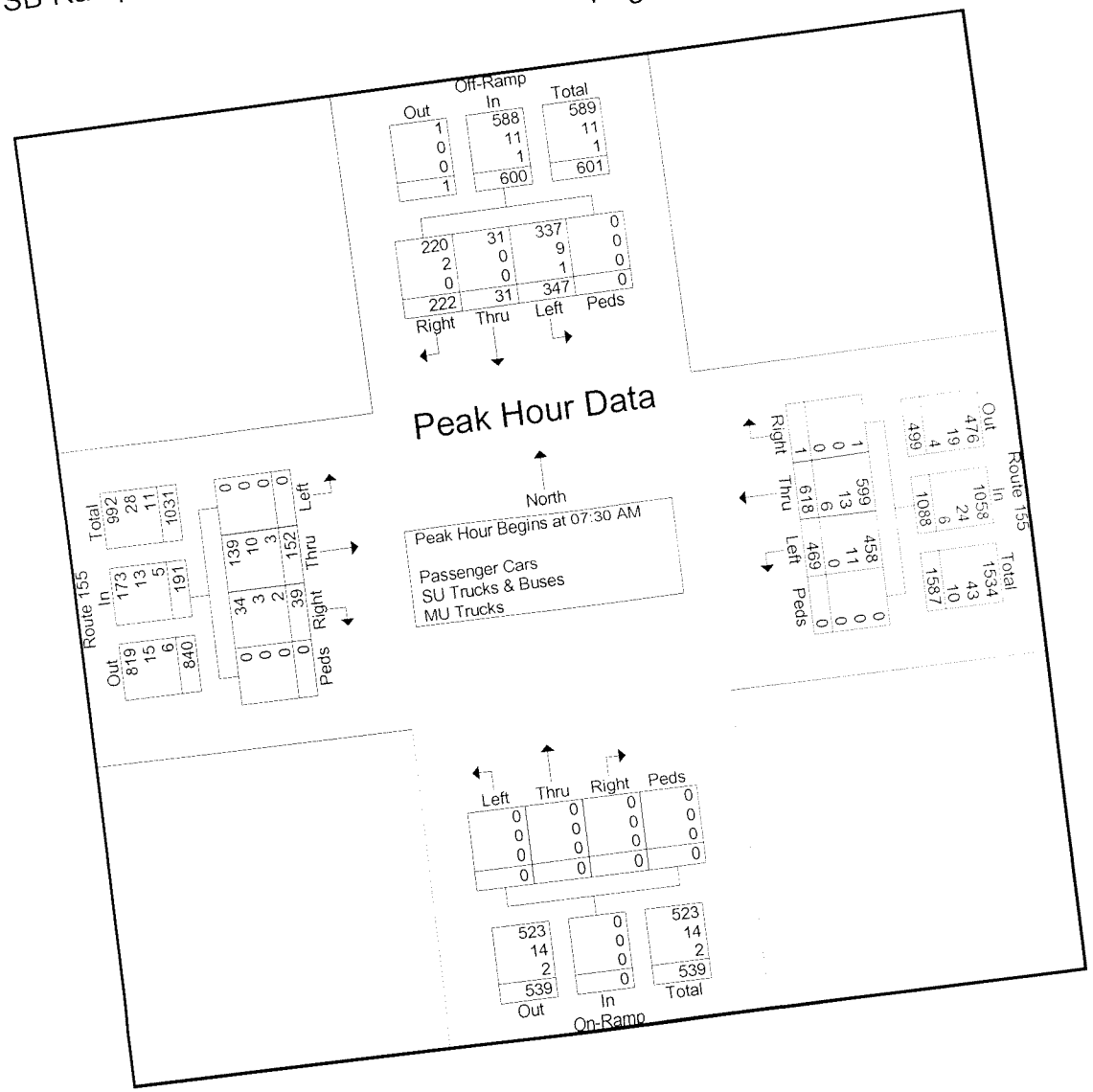
File Name : Watervliet Shaker Road & Exit 5 SB Ramp AM
Site Code : 11111111
Start Date : 1/27/2009
Page No : 4

Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB Ramp
AM
7 to 9



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Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB Ramp
AM
7 to 9

File Name : Watervliet Shaker Road & Exit 5 SB Ramp AM
Site Code : 11111111
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Off-Ramp Southbound					Route 155 Westbound					On-Ramp Northbound					Route 155 Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	30	6	68	0	104	0	91	60	0	151	0	0	0	0	0	5	16	0	0	21	276
07:15 AM	33	6	79	0	118	0	143	108	0	251	0	0	0	0	0	11	31	1	0	43	412
07:30 AM	51	6	91	0	148	0	132	102	0	234	0	0	0	0	0	7	39	0	0	46	428
07:45 AM	58	4	81	0	143	0	192	136	0	328	0	0	0	0	0	5	36	0	0	41	512
Total	172	22	319	0	513	0	558	406	0	964	0	0	0	0	0	28	122	1	0	151	1628
08:00 AM	56	12	89	0	157	0	151	112	0	263	0	0	0	0	0	14	47	0	0	61	481
08:15 AM	57	9	86	0	152	1	143	119	0	263	0	0	0	0	0	13	30	0	0	43	458
08:30 AM	50	8	86	0	144	1	109	100	0	210	0	0	0	0	0	6	43	0	0	49	403
08:45 AM	36	4	70	0	110	1	117	76	0	194	0	0	0	0	0	9	45	0	0	54	358
Total	199	33	331	0	563	3	520	407	0	930	0	0	0	0	0	42	165	0	0	207	1700
Grand Total	371	55	650	0	1076	3	1078	813	0	1894	0	0	0	0	0	70	287	1	0	358	3328
Apprch %	34.5	5.1	60.4	0		0.2	56.9	42.9	0		0	0	0	0		19.6	80.2	0.3	0		
Total %	11.1	1.7	19.5	0	32.3	0.1	32.4	24.4	0	56.9	0	0	0	0	0	2.1	8.6	0	0	10.8	
Passenger Cars																					
% Passenger Cars	99.2	100	98	0	98.5	66.7	97.6	98	0	97.7	0	0	0	0	0	85.7	93.4	100	0	91.9	97.4
SU Trucks & Buses	3	0	12	0	15	1	15	16	0	32	0	0	0	0	0	6	16	0	0	22	69
% SU Trucks & Buses	0.8	0	1.8	0	1.4	33.3	1.4	2	0	1.7	0	0	0	0	0	8.6	5.6	0	0	6.1	2.1
MU Trucks	0	0	1	0	1	0	11	0	0	11	0	0	0	0	0	4	3	0	0	7	19
% MU Trucks	0	0	0.2	0	0.1	0	1	0	0	0.6	0	0	0	0	0	5.7	1	0	0	2	0.6

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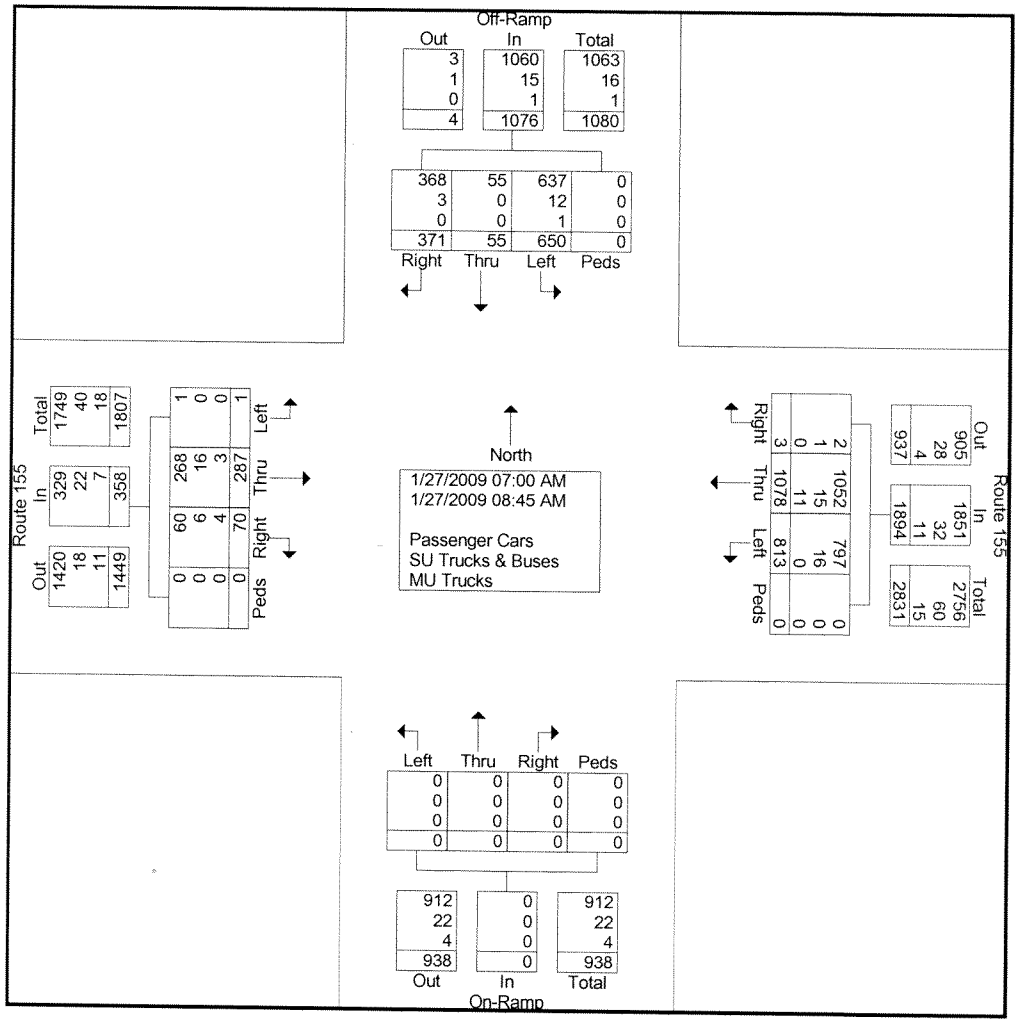
Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB Ramp
AM
7 to 9

File Name : Watervliet Shaker Road & Exit 5 SB Ramp AM
Site Code : 11111111
Start Date : 1/27/2009
Page No : 2



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Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB Ramp
AM
7 to 9

File Name : Watervliet Shaker Road & Exit 5 SB Ramp AM
Site Code : 11111111
Start Date : 1/27/2009

	Off-Ramp Southbound					Route 155 Westbound					On-Ramp Northbound					Route 155 Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	51	6	**91**				132	102								7	39				
07:45 AM	**58**	4	81	0	143	0	**192**	**136**	0	**328**	0	0	0	0	0	5	36	0	0	41	**512**
08:00 AM	56	**12**	89	0	**157**	0	151	112	0	263	0	0	0	0	0	**14**	**47**	0	0	**61**	481
08:15 AM	57	9	86	0	152	**1**	143	119	0	263	0	0	0	0	0	13	30	0	0	43	458
Total Volume	222	31	347	0	600	1	618	469	0	1088	0	0	0	0	0	39	152	0	0	191	1879
% App. Total	37	5.2	57.8	0		0.1	56.8	43.1	0		0	0	0	0		20.4	79.6	0	0		
PHF	.957	.646	.953	.000	.955	.250	.805	.862	.000	.829	.000	.000	.000	.000	.000	.696	.809	.000	.000	.783	.917
Passenger Cars	220	31	337	0	588	1	599	458	0	1058	0	0	0	0	0	34	139	0	0	173	1819
% Passenger Cars	99.1	100	97.1	0	98.0	100	96.9	97.7	0	97.2	0	0	0	0	0	87.2	91.4	0	0	90.6	96.8
SU Trucks & Buses	2	0	9	0	11	0	13	11	0	24	0	0	0	0	0	3	10	0	0	13	48
% SU Trucks & Buses	0.9	0	2.6	0	1.8	0	2.1	2.3	0	2.2	0	0	0	0	0	7.7	6.6	0	0	6.8	2.6
MU Trucks	0	0	1	0	1	0	6	0	0	6	0	0	0	0	0	2	3	0	0	5	12
% MU Trucks	0	0	0.3	0	0.2	0	1.0	0	0	0.6	0	0	0	0	0	5.1	2.0	0	0	2.6	0.6

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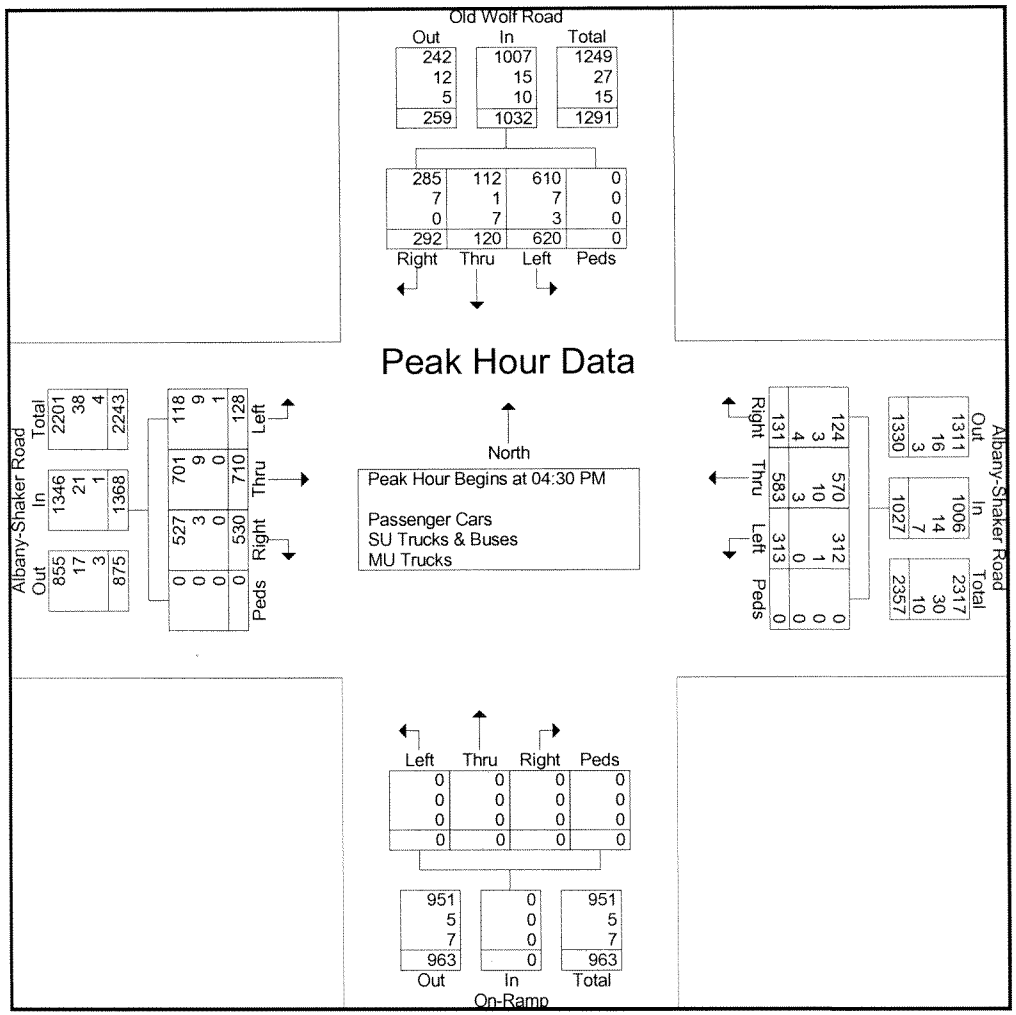
Exit 3/Exit 4
Old Wolf Road & Albany Shaker Road
PM
4 to 6

File Name : Albany Shaker Road & Old Wolf Road PM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 4



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Exit 3/Exit 4
Old Wolf Road & Albany Shaker Road
PM
4 to 6

File Name : Albany Shaker Road & Old Wolf Road PM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Old Wolf Road Southbound					Albany-Shaker Road Westbound					On-Ramp Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	76	31	160	0	267	30	155	92	0	277	0	0	0	0	0	115	143	23	1	282	826
04:15 PM	65	16	154	0	235	32	167	64	0	263	0	0	0	0	0	88	156	27	1	272	770
04:30 PM	82	30	141	0	253	35	152	76	0	263	0	0	0	0	0	130	171	29	0	330	846
04:45 PM	66	23	152	0	241	28	158	70	0	256	0	0	0	0	0	114	179	27	0	320	817
Total	289	100	607	0	996	125	632	302	0	1059	0	0	0	0	0	447	649	106	2	1204	3259
05:00 PM	70	41	166	0	277	26	137	96	0	259	0	0	0	0	0	141	163	28	0	332	868
05:15 PM	74	26	161	0	261	42	136	71	0	249	0	0	0	0	0	145	197	44	0	386	896
05:30 PM	69	8	133	0	210	50	167	71	0	288	0	0	0	0	0	128	148	23	0	299	797
05:45 PM	66	19	156	0	241	42	174	57	0	273	0	0	0	0	0	91	150	21	0	262	776
Total	279	94	616	0	989	160	614	295	0	1069	0	0	0	0	0	505	658	116	0	1279	3337
Grand Total	568	194	1223	0	1985	285	1246	597	0	2128	0	0	0	0	0	952	1307	222	2	2483	6596
Apprch %	28.6	9.8	61.6	0		13.4	58.6	28.1	0		0	0	0	0		38.3	52.6	8.9	0.1		
Total %	8.6	2.9	18.5	0	30.1	4.3	18.9	9.1	0	32.3	0	0	0	0	0	14.4	19.8	3.4	0	37.6	
Passenger Cars																					
% Passenger Cars	96.5	94.3	98.6	0	97.6	95.1	98.4	98.8	0	98.1	0	0	0	0	0	99.4	98.9	89.6	100	98.3	98
SU Trucks & Buses	19	4	11	0	34	7	17	5	0	29	0	0	0	0	0	5	13	21	0	39	102
% SU Trucks & Buses	3.3	2.1	0.9	0	1.7	2.5	1.4	0.8	0	1.4	0	0	0	0	0	0.5	1	9.5	0	1.6	1.5
MU Trucks	1	7	6	0	14	7	3	2	0	12	0	0	0	0	0	1	1	2	0	4	30
% MU Trucks	0.2	3.6	0.5	0	0.7	2.5	0.2	0.3	0	0.6	0	0	0	0	0	0.1	0.1	0.9	0	0.2	0.5

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Exit 3/Exit 4
Old Wolf Road & Albany Shaker Road
PM
4 to 6

File Name : Albany Shaker Road & Old Wolf Road PM
Site Code : 12345678
Start Date : 1/27/2009
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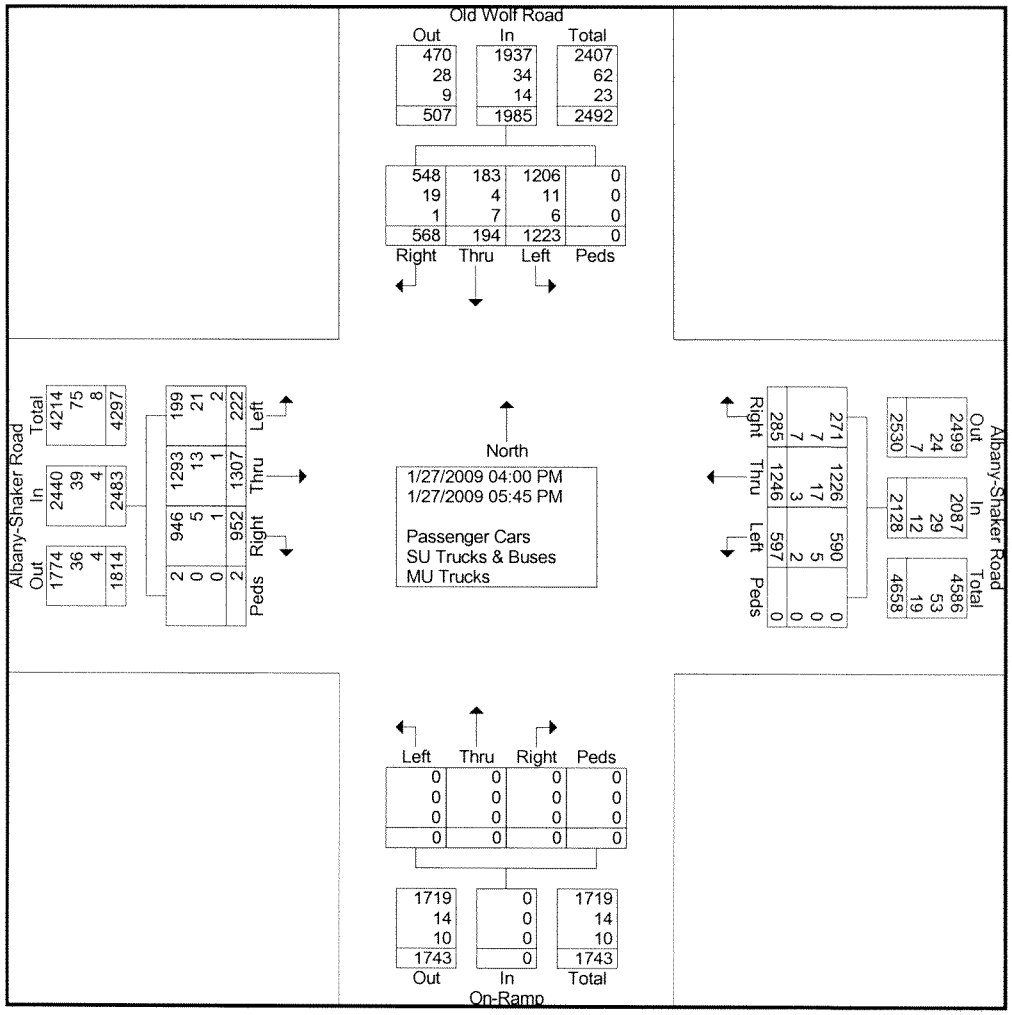

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Exit 3/Exit 4
Old Wolf Road & Albany Shaker Road
PM
4 to 6

File Name : Albany Shaker Road & Old Wolf Road PM
Site Code : 12345678
Start Date : 1/27/2009
Page No : 3

	Old Wolf Road Southbound					Albany-Shaker Road Westbound					On-Ramp Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	**82**	30	141			35	152	76		**263**						130	171	29			
04:45 PM	66	23	152	0	241	28	**158**	70	0	256	0	0	0	0	0	114	179	27	0	320	817
05:00 PM	70	**41**	**166**	0	**277**	26	137	**96**	0	259	0	0	0	0	0	141	163	28	0	332	868
05:15 PM	74	26	161	0	261	**42**	136	71	0	249	0	0	0	0	0	**145**	**197**	**44**	0	**386**	**896**
Total Volume	292	120	620	0	1032	131	583	313	0	1027	0	0	0	0	0	530	710	128	0	1368	3427
% App. Total	28.3	11.6	60.1	0		12.8	56.8	30.5	0		0	0	0	0		38.7	51.9	9.4	0		
PHF	.890	.732	.934	.000	.931	.780	.922	.815	.000	.976	.000	.000	.000	.000	.000	.914	.901	.727	.000	.886	.956
Passenger Cars	285	112	610	0	1007	124	570	312	0	1006	0	0	0	0	0	527	701	118	0	1346	3359
% Passenger Cars	97.6	93.3	98.4	0	97.6	94.7	97.8	99.7	0	98.0	0	0	0	0	0	99.4	98.7	92.2	0	98.4	98.0
SU Trucks & Buses	7	1	7	0	15	3	10	1	0	14	0	0	0	0	0	3	9	9	0	21	50
% SU Trucks & Buses	2.4	0.8	1.1	0	1.5	2.3	1.7	0.3	0	1.4	0	0	0	0	0	0.6	1.3	7.0	0	1.5	1.5
MU Trucks	0	7	3	0	10	4	3	0	0	7	0	0	0	0	0	0	0	1	0	1	18
% MU Trucks	0	5.8	0.5	0	1.0	3.1	0.5	0	0	0.7	0	0	0	0	0	0	0	0.8	0	0.1	0.5

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Exit 3/Exit 4
Albany Shaker Road & Wolf Road
PM
4 to 6

File Name : Albany Shaker Road & Wolf Road PM
Site Code : 01270982
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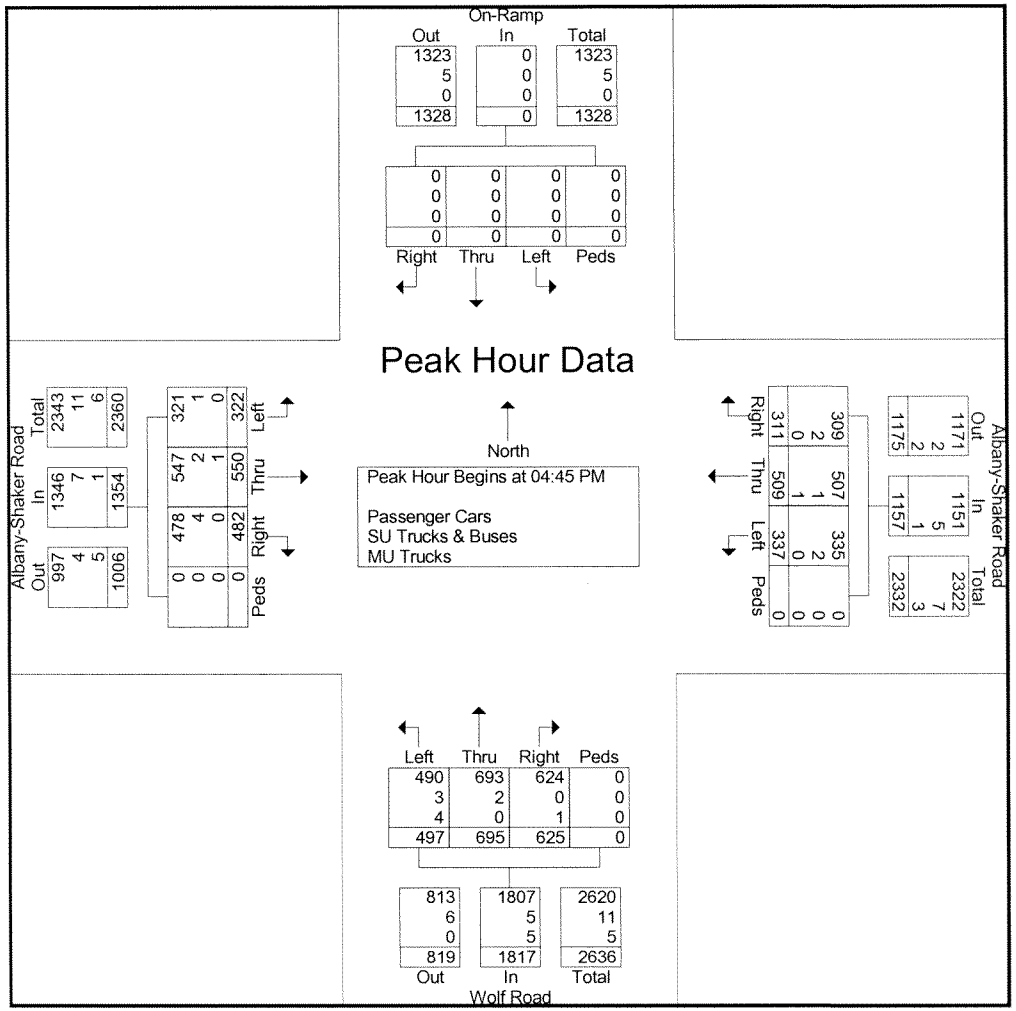

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Exit 3/Exit 4
Albany Shaker Road & Wolf Road
PM
4 to 6

File Name : Albany Shaker Road & Wolf Road PM
Site Code : 01270982
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	On-Ramp Southbound					Albany-Shaker Road Westbound					Wolf Road Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	72	130	73	0	275	154	176	143	0	473	98	115	86	0	299	1047
04:15 PM	0	0	0	0	0	67	111	83	0	261	141	151	154	0	446	119	136	69	0	324	1031
04:30 PM	0	0	0	0	0	61	133	63	1	258	149	187	139	0	475	109	130	70	0	309	1042
04:45 PM	0	0	0	0	0	87	117	84	0	288	168	172	129	0	469	111	158	64	0	333	1090
Total	0	0	0	0	0	287	491	303	1	1082	612	686	565	0	1863	437	539	289	0	1265	4210
05:00 PM	0	0	0	0	0	53	126	97	0	276	144	160	125	0	429	121	117	101	0	339	1044
05:15 PM	0	0	0	0	0	98	124	78	0	300	159	185	124	0	468	132	156	93	0	381	1149
05:30 PM	0	0	0	0	0	73	142	78	0	293	154	178	119	0	451	118	119	64	0	301	1045
05:45 PM	0	0	0	0	0	70	127	90	0	287	164	126	114	0	404	113	117	74	0	304	995
Total	0	0	0	0	0	294	519	343	0	1156	621	649	482	0	1752	484	509	332	0	1325	4233
Grand Total	0	0	0	0	0	581	1010	646	1	2238	1233	1335	1047	0	3615	921	1048	621	0	2590	8443
Apprch %	0	0	0	0		26	45.1	28.9	0		34.1	36.9	29	0		35.6	40.5	24	0		
Total %	0	0	0	0	0	6.9	12	7.7	0	26.5	14.6	15.8	12.4	0	42.8	10.9	12.4	7.4	0	30.7	
Passenger Cars																					
% Passenger Cars	0	0	0	0	0	99.7	99.3	99.5	100	99.5	99.8	99.6	98.8	0	99.4	99.3	99.5	99.8	0	99.5	99.5
SU Trucks & Buses	0	0	0	0	0	2	5	3	0	10	1	5	7	0	13	6	3	1	0	10	33
% SU Trucks & Buses	0	0	0	0	0	0.3	0.5	0.5	0	0.4	0.1	0.4	0.7	0	0.4	0.7	0.3	0.2	0	0.4	0.4
MU Trucks	0	0	0	0	0	0	2	0	0	2	2	1	6	0	9	0	2	0	0	2	13
% MU Trucks	0	0	0	0	0	0	0.2	0	0	0.1	0.2	0.1	0.6	0	0.2	0	0.2	0	0	0.1	0.2

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Exit 3/Exit 4
Albany Shaker Road & Wolf Road
PM
4 to 6

File Name : Albany Shaker Road & Wolf Road PM
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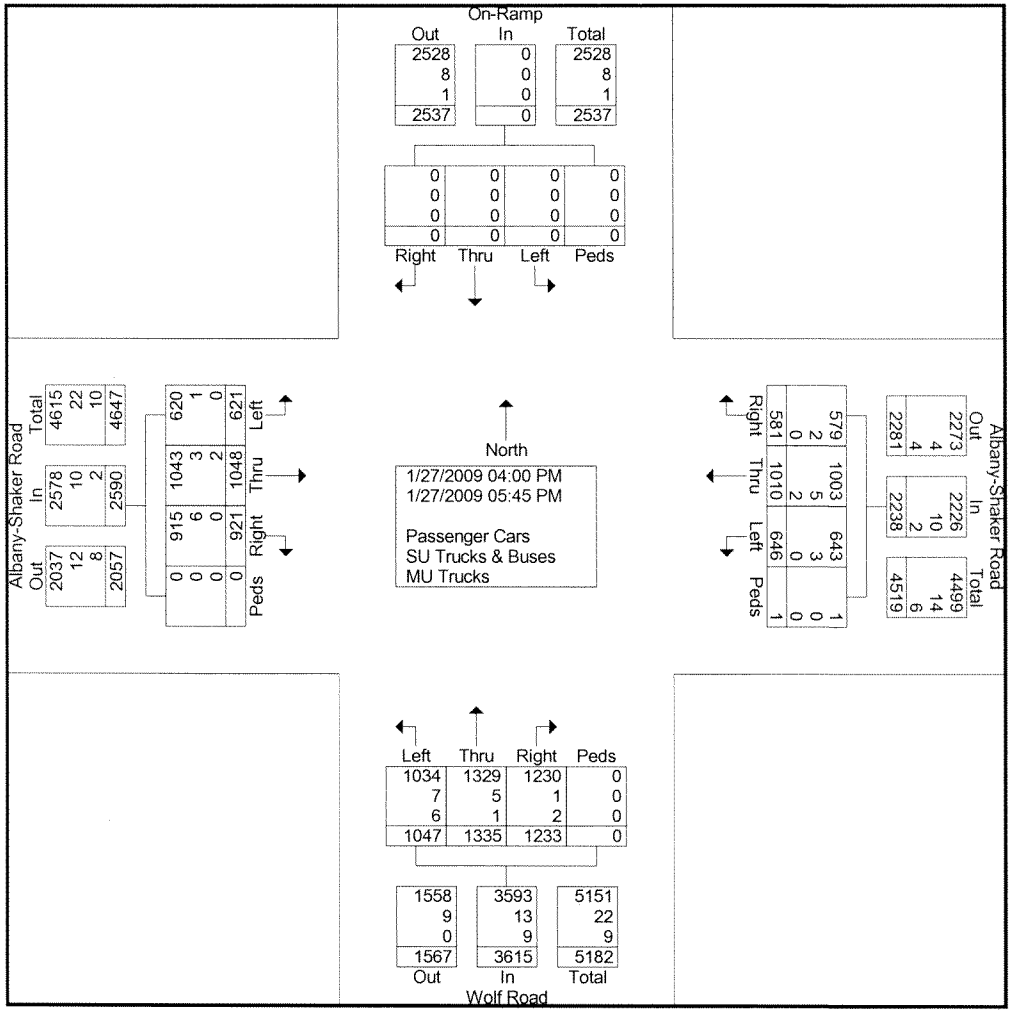

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Exit 3/Exit 4
Albany Shaker Road & Wolf Road
PM
4 to 6

File Name : Albany Shaker Road & Wolf Road PM
Site Code : 01270982
Start Date : 1/27/2009
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	On-Ramp Southbound					Albany-Shaker Road Westbound					Wolf Road Northbound					Albany-Shaker Road Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	87	117	84	0	288	**168**	172	**129**		**469**	111	**158**	64			
05:00 PM	0	0	0	0	0	53	126	**97**	0	276	144	160	125	0	429	121	117	**101**	0	339	1044
05:15 PM	0	0	0	0	0	**98**	124	78	0	**300**	159	**185**	124	0	468	**132**	156	93	0	**381**	**1149**
05:30 PM	0	0	0	0	0	73	**142**	78	0	293	154	178	119	0	451	118	119	64	0	301	1045
Total Volume	0	0	0	0	0	311	509	337	0	1157	625	695	497	0	1817	482	550	322	0	1354	4328
% App. Total	0	0	0	0		26.9	44	29.1	0		34.4	38.2	27.4	0		35.6	40.6	23.8	0		
PHF	.000	.000	.000	.000	.000	.793	.896	.869	.000	.964	.930	.939	.963	.000	.969	.913	.870	.797	.000	.888	.942
Passenger Cars	0	0	0	0	0	309	507	335	0	1151	624	693	490	0	1807	478	547	321	0	1346	4304
% Passenger Cars	0	0	0	0	0	99.4	99.6	99.4	0	99.5	99.8	99.7	98.6	0	99.4	99.2	99.5	99.7	0	99.4	99.4
SU Trucks & Buses	0	0	0	0	0	2	1	2	0	5	0	2	3	0	5	4	2	1	0	7	17
% SU Trucks & Buses	0	0	0	0	0	0.6	0.2	0.6	0	0.4	0	0.3	0.6	0	0.3	0.8	0.4	0.3	0	0.5	0.4
MU Trucks	0	0	0	0	0	0	1	0	0	1	1	0	4	0	5	0	1	0	0	1	7
% MU Trucks	0	0	0	0	0	0	0.2	0	0	0.1	0.2	0	0.8	0	0.3	0	0.2	0	0	0.1	0.2

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Exit 3/Exit 4
Exit 4 NB Off-Ramp
PM
4-6

File Name : Exit 4 NB Off-Ramp PM
Site Code : 00000000
Start Date : 1/27/2009
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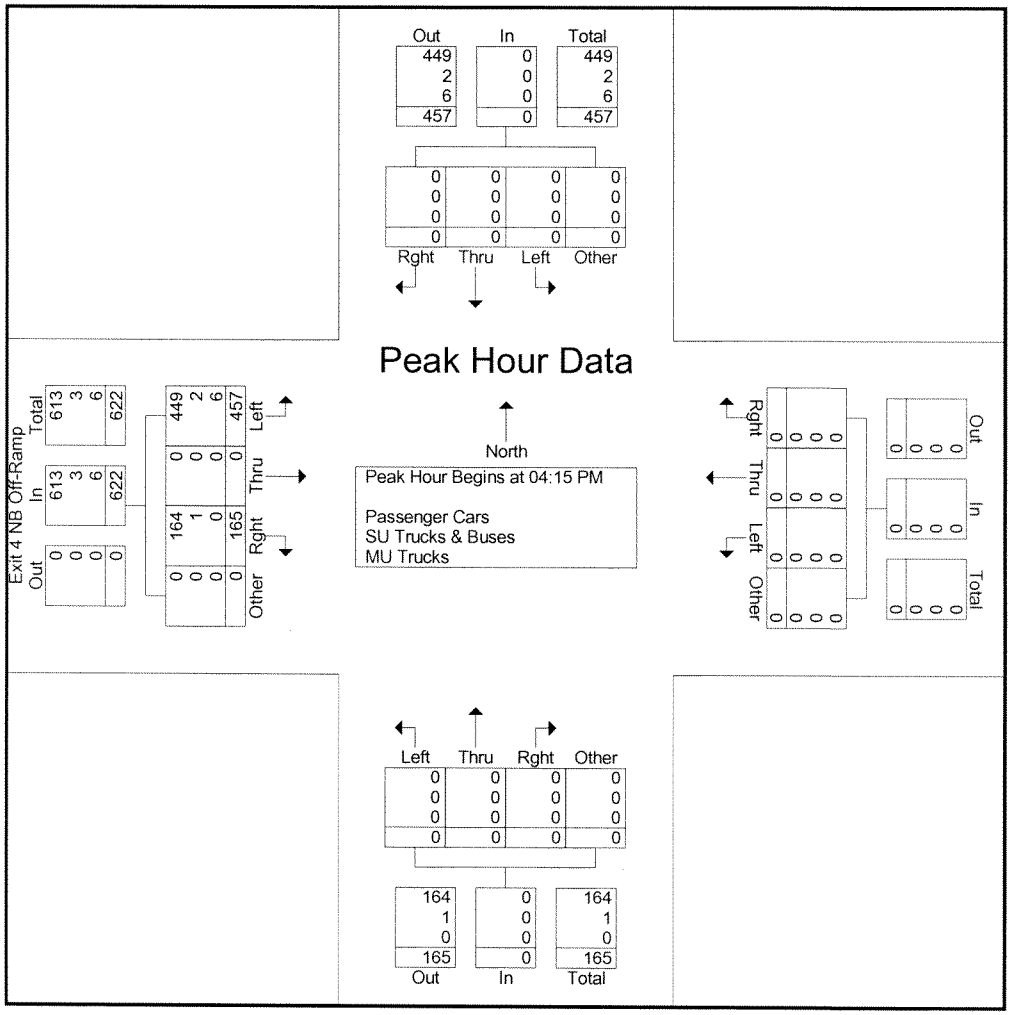

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Exit 3/Exit 4
Exit 4 NB Off-Ramp
PM
4-6

File Name : Exit 4 NB Off-Ramp PM
Site Code : 00000000
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Southbound					Westbound					Northbound					Exit 4 NB Off-Ramp Eastbound					
Start Time	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	111	0	132	132
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	127	0	170	170
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	90	0	123	123
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	134	0	180	180
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143	0	462	0	605	605
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	106	0	149	149
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	88	0	134	134
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	94	0	130	130
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	132	0	178	178
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	171	0	420	0	591	591
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	314	0	882	0	1196	1196
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		26.3	0	73.7	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26.3	0	73.7	0	100	
Passenger Cars																					
% Passenger Cars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99	0	98.1	0	98.3	98.3
SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	7	0	10	10
% SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.8	0	0.8	0.8
MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	10
% MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0	0.8	0.8

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Exit 3/Exit 4
Exit 4 NB Off-Ramp
PM
4-6

File Name : Exit 4 NB Off-Ramp PM
Site Code : 00000000
Start Date : 1/27/2009
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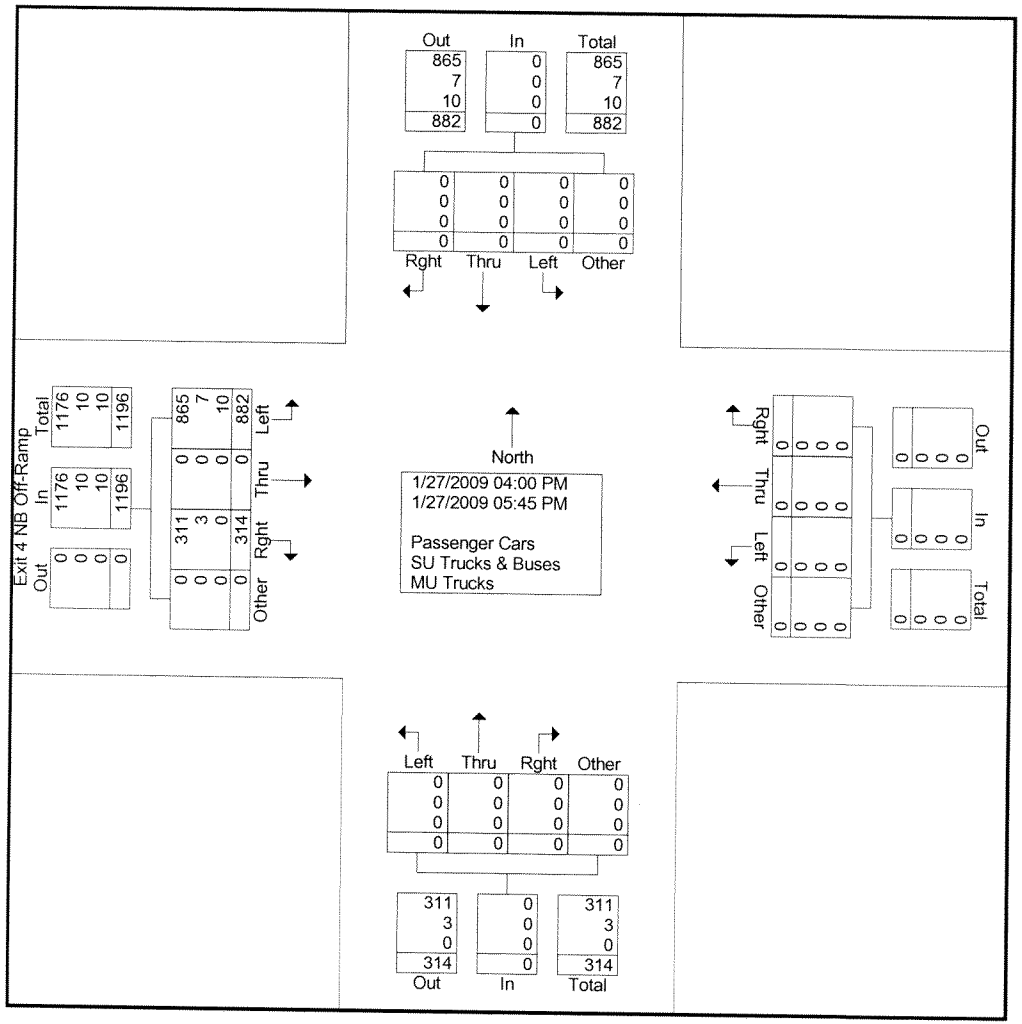

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Exit 4 NB Off-Ramp
PM
4-6

File Name : Exit 4 NB Off-Ramp PM
Site Code : 00000000
Start Date : 1/27/2009
Page No : 3

	Southbound					Westbound					Northbound					Exit 4 NB Off-Ramp Eastbound					
Start Time	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Rght	Thru	Left	Other	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	127	0	170	170
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	90	0	123	123
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**46**		**134**		**180**	**180**
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	106	0	149	149
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	165	0	457	0	622	622
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		26.5	0	73.5	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.897	.000	.853	.000	.864	.864
Passenger Cars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	164	0	449	0	613	613
% Passenger Cars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	99.4	0	98.2	0	98.6	98.6
SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	3	3
% SU Trucks & Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0.4	0	0.5	0.5
MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	6
% MU Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0	1.0	1.0

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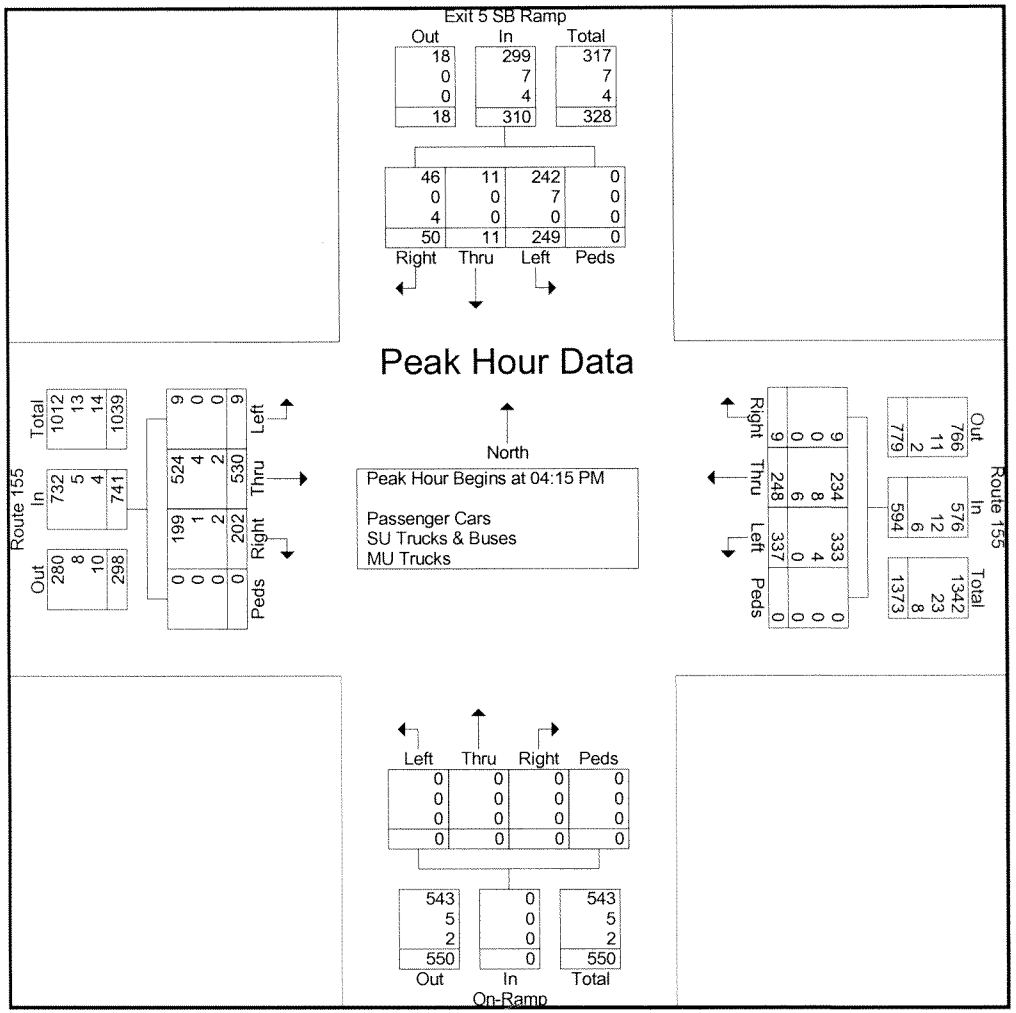
Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB
PM
4 to 6

File Name : Watervliet Shaker Road & Exit 5 SB Ramp PM
Site Code : 11111111
Start Date : 1/27/2009
Page No : 4



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Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB
PM
4 to 6

File Name : Watervliet Shaker Road & Exit 5 SB Ramp PM
Site Code : 11111111
Start Date : 1/27/2009

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Exit 5 SB Ramp Southbound					Route 155 Westbound					On-Ramp Northbound					Route 155 Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	19	2	74	0	95	1	57	85	0	143	0	0	0	0	0	51	116	1	0	168	406
04:15 PM	9	5	70	0	84	5	69	76	0	150	0	0	0	0	0	39	105	3	0	147	381
04:30 PM	17	1	53	0	71	2	55	103	0	160	0	0	0	0	0	42	135	2	0	179	410
04:45 PM	12	4	68	0	84	1	69	76	0	146	0	0	0	0	0	46	112	0	0	158	388
Total	57	12	265	0	334	9	250	340	0	599	0	0	0	0	0	178	468	6	0	652	1585
05:00 PM	12	1	58	0	71	1	55	82	0	138	0	0	0	0	0	75	178	4	0	257	466
05:15 PM	10	4	69	0	83	2	56	74	0	132	0	0	0	0	0	33	116	4	1	154	369
05:30 PM	7	12	84	0	103	2	59	69	0	130	0	0	0	0	0	23	92	1	0	116	349
05:45 PM	9	4	64	0	77	1	37	67	0	105	0	0	0	0	0	18	54	1	0	73	255
Total	38	21	275	0	334	6	207	292	0	505	0	0	0	0	0	149	440	10	1	600	1439
Grand Total	95	33	540	0	668	15	457	632	0	1104	0	0	0	0	0	327	908	16	1	1252	3024
Apprch %	14.2	4.9	80.8	0		1.4	41.4	57.2	0		0	0	0	0		26.1	72.5	1.3	0.1		
Total %	3.1	1.1	17.9	0	22.1	0.5	15.1	20.9	0	36.5	0	0	0	0	0	10.8	30	0.5	0	41.4	
Passenger Cars																					
% Passenger Cars	93.7	100	98.3	0	97.8	100	92.6	99.2	0	96.5	0	0	0	0	0	99.1	99	100	100	99	97.8
SU Trucks & Buses	1	0	9	0	10	0	19	5	0	24	0	0	0	0	0	1	7	0	0	8	42
% SU Trucks & Buses	1.1	0	1.7	0	1.5	0	4.2	0.8	0	2.2	0	0	0	0	0	0.3	0.8	0	0	0.6	1.4
MU Trucks	5	0	0	0	5	0	15	0	0	15	0	0	0	0	0	2	2	0	0	4	24
% MU Trucks	5.3	0	0	0	0.7	0	3.3	0	0	1.4	0	0	0	0	0	0.6	0.2	0	0	0.3	0.8

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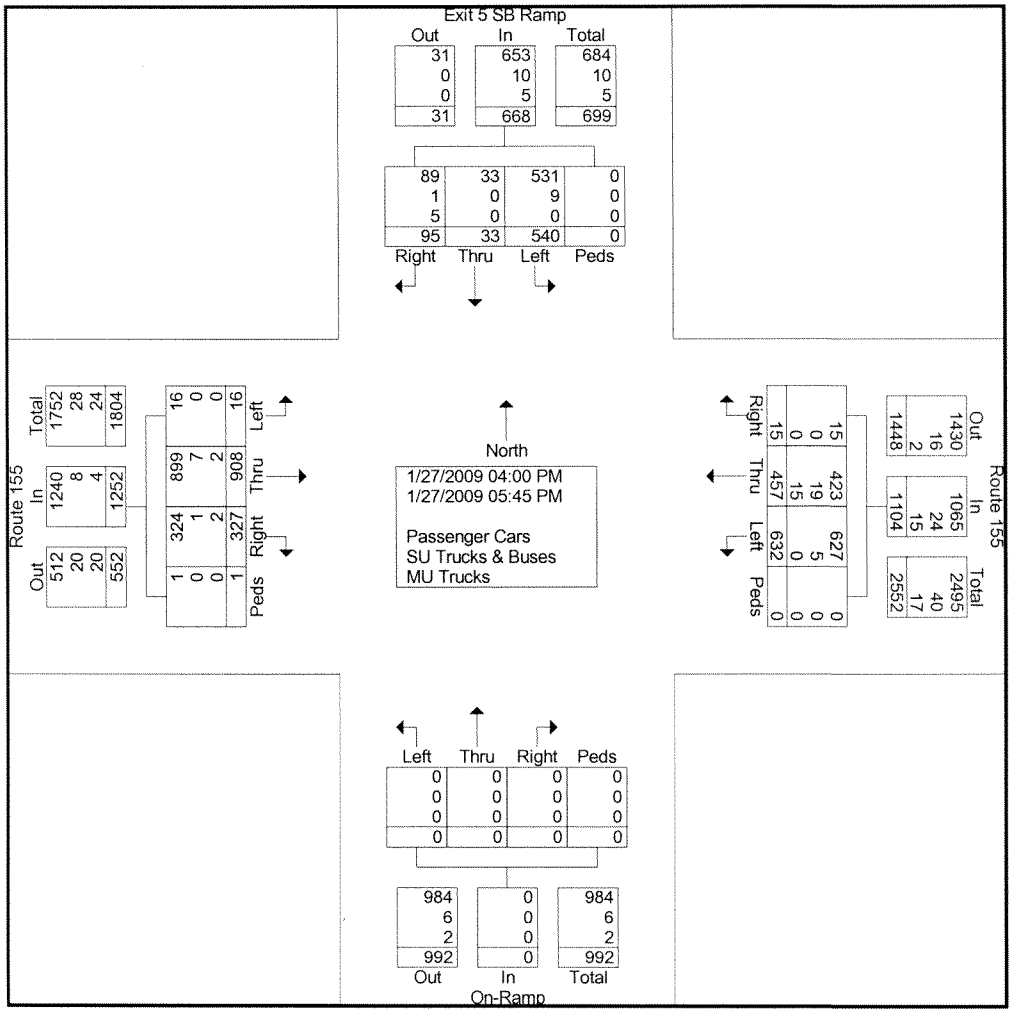
Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB
PM
4 to 6

File Name : Watervliet Shaker Road & Exit 5 SB Ramp PM
Site Code : 11111111
Start Date : 1/27/2009



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Exit 3/Exit 4
Watervliet Shaker Road & Exit 5 SB
PM
4 to 6

File Name : Watervliet Shaker Road & Exit 5 SB Ramp PM
Site Code : 11111111
Start Date : 1/27/2009
Page No : 3

	Exit 5 SB Ramp Southbound					Route 155 Westbound					On-Ramp Northbound					Route 155 Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	9	**5**	**70**		**84**	**5**	**69**	76								39	105	3			
04:30 PM	**17**	1	53	0	71	2	55	**103**	0	**160**	0	0	0	0	0	42	135	2	0	179	410
04:45 PM	12	4	68	0	84	1	69	76	0	146	0	0	0	0	0	46	112	0	0	158	388
05:00 PM	12	1	58	0	71	1	55	82	0	138	0	0	0	0	0	**75**	**178**	**4**	0	**257**	**466**
Total Volume	50	11	249	0	310	9	248	337	0	594	0	0	0	0	0	202	530	9	0	741	1645
% App. Total	16.1	3.5	80.3	0		1.5	41.8	56.7	0		0	0	0	0		27.3	71.5	1.2	0		
PHF	.735	.550	.889	.000	.923	.450	.899	.818	.000	.928	.000	.000	.000	.000	.000	.673	.744	.563	.000	.721	.883
Passenger Cars	46	11	242	0	299	9	234	333	0	576	0	0	0	0	0	199	524	9	0	732	1607
% Passenger Cars	92.0	100	97.2	0	96.5	100	94.4	98.8	0	97.0	0	0	0	0	0	98.5	98.9	100	0	98.8	97.7
SU Trucks & Buses	0	0	7	0	7	0	8	4	0	12	0	0	0	0	0	1	4	0	0	5	24
% SU Trucks & Buses	0	0	2.8	0	2.3	0	3.2	1.2	0	2.0	0	0	0	0	0	0.5	0.8	0	0	0.7	1.5
MU Trucks	4	0	0	0	4	0	6	0	0	6	0	0	0	0	0	2	2	0	0	4	14
% MU Trucks	8.0	0	0	0	1.3	0	2.4	0	0	1.0	0	0	0	0	0	1.0	0.4	0	0	0.5	0.9

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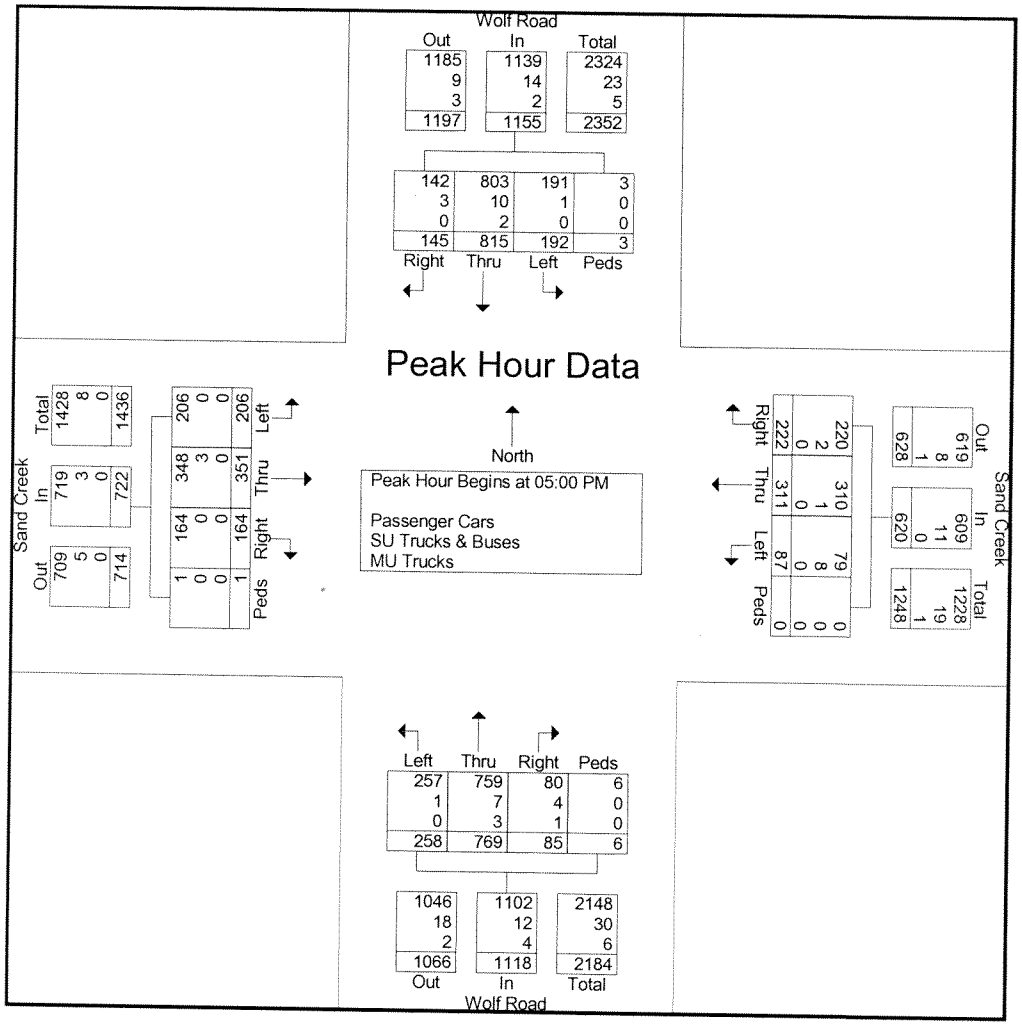
Exit 3/ Exit 4
Sand Creek & Wolf Road
PM
4 to 6

File Name : Sand Creek & Wolf Road TOTAL PM
Site Code : 87654321
Start Date : 1/27/2009
Page No : 4



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Exit 3/ Exit 4
Sand Creek & Wolf Road
PM
4 to 6

File Name : Sand Creek & Wolf Road TOTAL PM
Site Code : 87654321
Start Date : 1/27/2009
Page No : 1

Groups Printed- Passenger Cars - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Sand Creek Westbound					Wolf Road Northbound					Sand Creek Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	38	188	62	5	293	49	67	23	0	139	19	155	52	0	226	33	60	43	1	137	795
04:15 PM	30	158	43	1	232	45	62	19	0	126	20	155	71	2	248	35	78	48	1	162	768
04:30 PM	36	197	44	0	277	54	78	13	0	145	15	197	81	5	298	48	84	52	0	184	904
04:45 PM	33	149	56	1	239	51	77	22	0	150	14	181	68	3	266	41	72	50	0	163	818
Total	137	692	205	7	1041	199	284	77	0	560	68	688	272	10	1038	157	294	193	2	646	3285
05:00 PM	41	241	57	3	342	49	85	21	0	155	15	175	65	1	256	40	63	53	0	156	909
05:15 PM	47	190	53	0	290	50	84	24	0	158	23	197	55	1	276	41	114	49	1	205	929
05:30 PM	27	218	42	0	287	72	77	15	0	164	26	215	72	3	316	42	80	55	0	177	944
05:45 PM	30	166	40	0	236	51	65	27	0	143	21	182	66	1	270	41	94	49	0	184	833
Total	145	815	192	3	1155	222	311	87	0	620	85	769	258	6	1118	164	351	206	1	722	3615
Grand Total	282	1507	397	10	2196	421	595	164	0	1180	153	1457	530	16	2156	321	645	399	3	1368	6900
Apprch %	12.8	68.6	18.1	0.5		35.7	50.4	13.9	0		7.1	67.6	24.6	0.7		23.5	47.1	29.2	0.2		
Total %	4.1	21.8	5.8	0.1	31.8	6.1	8.6	2.4	0	17.1	2.2	21.1	7.7	0.2	31.2	4.7	9.3	5.8	0	19.8	
Passenger Cars																					
% Passenger Cars	98.2	98.7	99.7	100	98.8	99	98.8	90.9	0	97.8	93.5	98.8	99.2	100	98.6	99.4	99.5	99.7	100	99.6	98.7
SU Trucks & Buses	4	17	1	0	22	3	7	15	0	25	9	12	4	0	25	2	3	1	0	6	78
% SU Trucks & Buses	1.4	1.1	0.3	0	1	0.7	1.2	9.1	0	2.1	5.9	0.8	0.8	0	1.2	0.6	0.5	0.3	0	0.4	1.1
MU Trucks	1	3	0	0	4	1	0	0	0	1	1	5	0	0	6	0	0	0	0	0	11
% MU Trucks	0.4	0.2	0	0	0.2	0.2	0	0	0	0.1	0.7	0.3	0	0	0.3	0	0	0	0	0	0.2

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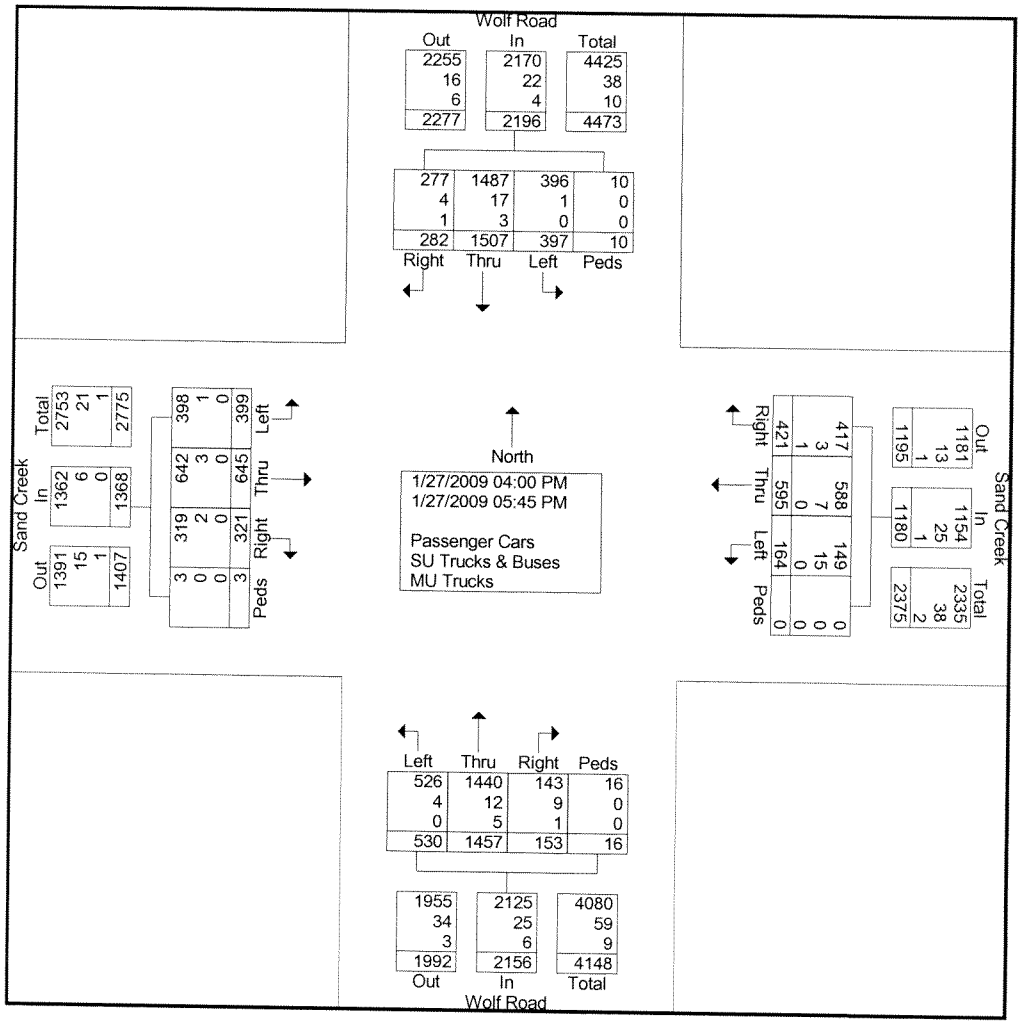
Exit 3/ Exit 4
Sand Creek & Wolf Road
PM
4 to 6

File Name : Sand Creek & Wolf Road TOTAL PM
Site Code : 87654321
Start Date : 1/27/2009
Page No : 2



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Exit 3/ Exit 4
Sand Creek & Wolf Road
PM
4 to 6

File Name : Sand Creek & Wolf Road TOTAL PM
Site Code : 87654321
Start Date : 1/27/2009
Page No : 3

	Wolf Road Southbound					Sand Creek Westbound					Wolf Road Northbound					Sand Creek Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	41	**241**	**57**	**3**	**342**		**85**														
05:15 PM	**47**	190	53	0	290	50	84	24	0	158	23	197	55	1	276	41	**114**	49	**1**	**205**	929
05:30 PM	27	218	42	0	287	**72**	77	15	0	**164**	**26**	**215**	**72**	**3**	**316**	**42**	80	**55**	0	177	**944**
05:45 PM	30	166	40	0	236	51	65	**27**	0	143	21	182	66	1	270	41	94	49	0	184	833
Total Volume	145	815	192	3	1155	222	311	87	0	620	85	769	258	6	1118	164	351	206	1	722	3615
% App. Total	12.6	70.6	16.6	0.3		35.8	50.2	14	0		7.6	68.8	23.1	0.5		22.7	48.6	28.5	0.1		
PHF	.771	.845	.842	.250	.844	.771	.915	.806	.000	.945	.817	.894	.896	.500	.884	.976	.770	.936	.250	.880	.957
Passenger Cars	142	803	191	3	1139	220	310	79	0	609	80	759	257	6	1102	164	348	206	1	719	3569
% Passenger Cars	97.9	98.5	99.5	100	98.6	99.1	99.7	90.8	0	98.2	94.1	98.7	99.6	100	98.6	100	99.1	100	100	99.6	98.7
SU Trucks & Buses	3	10	1	0	14	2	1	8	0	11	4	7	1	0	12	0	3	0	0	3	40
% SU Trucks & Buses	2.1	1.2	0.5	0	1.2	0.9	0.3	9.2	0	1.8	4.7	0.9	0.4	0	1.1	0	0.9	0	0	0.4	1.1
MU Trucks	0	2	0	0	2	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	6
% MU Trucks	0	0.2	0	0	0.2	0	0	0	0	0	1.2	0.4	0	0	0.4	0	0	0	0	0	0.2

Manual Turning Movement Count

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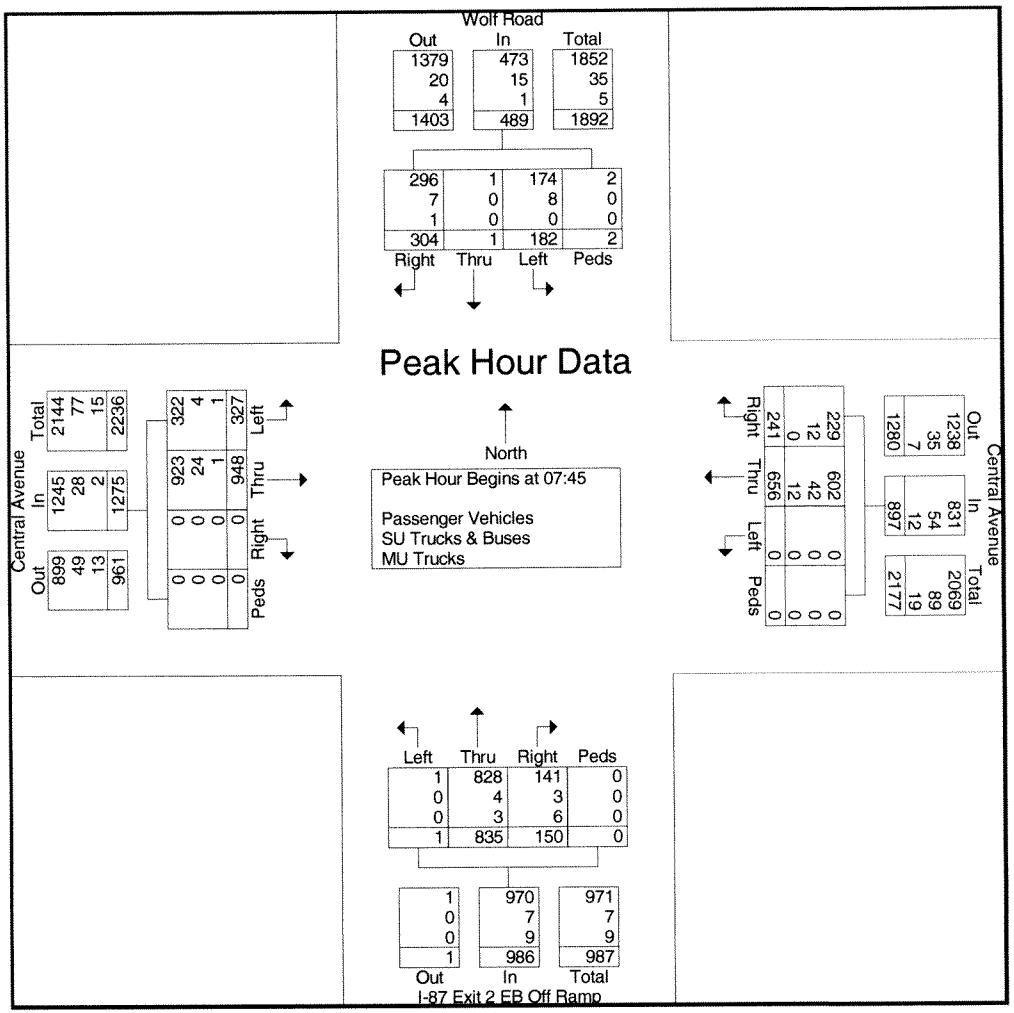
Exit 3 Airport Connector
Wolf Rd & Central Ave
AM
7 to 9

File Name : Wolf - Central AM
Site Code : 62906009
Start Date : 6/29/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Central Ave
AM
7 to 9

File Name : Wolf - Central AM
Site Code : 62906009
Start Date : 6/29/2006
Page No : 3

	Wolf Road Southbound					Central Avenue Westbound					I-87 Exit 2 EB Off Ramp Northbound					Central Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	**49**						**173**					**216**	**40**				**273**			**344**	**954**
08:00	41	0	70	0	111	0	165	48	0	213	**1**	216	40	0	**257**	**89**	246	0	0	335	916
08:15	47	0	**88**	0	**135**	0	167	**70**	0	**237**	0	215	32	0	247	79	229	0	0	308	927
08:30	45	**1**	77	**2**	125	0	151	60	0	211	0	188	38	0	226	88	200	0	0	288	850
Total Volume	182	1	304	2	489	0	656	241	0	897	1	835	150	0	986	327	948	0	0	1275	3647
% App. Total	37.2	0.2	62.2	0.4		0	73.1	26.9	0		0.1	84.7	15.2	0		25.6	74.4	0	0		
PHF	.929	.250	.864	.250	.906	.000	.948	.861	.000	.946	.250	.966	.938	.000	.959	.919	.868	.000	.000	.927	.956
Passenger Vehicles	174	1	296	2	473	0	602	229	0	831	1	828	141	0	970	322	923	0	0	1245	3519
% Passenger Vehicles	95.6	100	97.4	100	96.7	0	91.8	95.0	0	92.6	100	99.2	94.0	0	98.4	98.5	97.4	0	0	97.6	96.5
SU Trucks & Buses	8	0	7	0	15	0	42	12	0	54	0	4	3	0	7	4	24	0	0	28	104
% SU Trucks & Buses	4.4	0	2.3	0	3.1	0	6.4	5.0	0	6.0	0	0.5	2.0	0	0.7	1.2	2.5	0	0	2.2	2.9
MU Trucks	0	0	1	0	1	0	12	0	0	12	0	3	6	0	9	1	1	0	0	2	24
% MU Trucks	0	0	0.3	0	0.2	0	1.8	0	0	1.3	0	0.4	4.0	0	0.9	0.3	0.1	0	0	0.2	0.7

Manual Turning Movement Count

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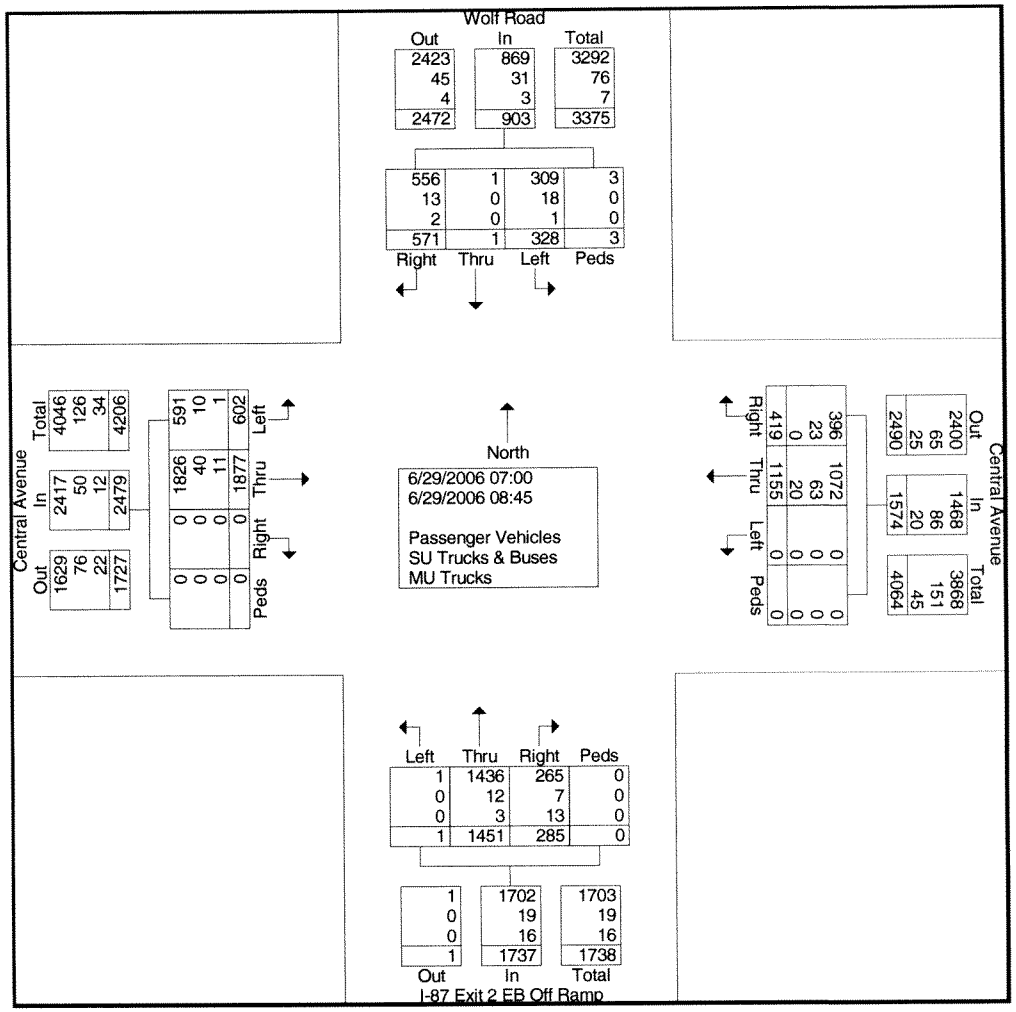
Exit 3 Airport Connector
Wolf Rd & Central Ave
AM
7 to 9

File Name : Wolf - Central AM
Site Code : 62906009
Start Date : 6/29/2006
Page No : 2



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Central Ave
AM
7 to 9

File Name : Wolf - Central AM
Site Code : 62906009
Start Date : 6/29/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Central Avenue Westbound					I-87 Exit 2 EB Off Ramp Northbound					Central Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00	27	0	52	1	80	0	92	35	0	127	0	141	27	0	168	59	211	0	0	270	645
07:15	37	0	54	0	91	0	117	39	0	156	0	137	25	0	162	56	200	0	0	256	665
07:30	27	0	67	0	94	0	136	46	0	182	0	160	40	0	200	74	274	0	0	348	824
07:45	49	0	69	0	118	0	173	63	0	236	0	216	40	0	256	71	273	0	0	344	954
Total	140	0	242	1	383	0	518	183	0	701	0	654	132	0	786	260	958	0	0	1218	3088
08:00	41	0	70	0	111	0	165	48	0	213	1	216	40	0	257	89	246	0	0	335	916
08:15	47	0	88	0	135	0	167	70	0	237	0	215	32	0	247	79	229	0	0	308	927
08:30	45	1	77	2	125	0	151	60	0	211	0	188	38	0	226	88	200	0	0	288	850
08:45	55	0	94	0	149	0	154	58	0	212	0	178	43	0	221	86	244	0	0	330	912
Total	188	1	329	2	520	0	637	236	0	873	1	797	153	0	951	342	919	0	0	1261	3605
Grand Total	328	1	571	3	903	0	1155	419	0	1574	1	1451	285	0	1737	602	1877	0	0	2479	6693
Apprch %	36.3	0.1	63.2	0.3		0	73.4	26.6	0		0.1	83.5	16.4	0		24.3	75.7	0	0		
Total %	4.9	0	8.5	0	13.5	0	17.3	6.3	0	23.5	0	21.7	4.3	0	26	9	28	0	0	37	
Passenger Vehicles																					
% Passenger Vehicles	94.2	100	97.4	100	96.2	0	92.8	94.5	0	93.3	100	99	93	0	98	98.2	97.3	0	0	97.5	96.5
SU Trucks & Buses	18	0	13	0	31	0	63	23	0	86	0	12	7	0	19	10	40	0	0	50	186
% SU Trucks & Buses	5.5	0	2.3	0	3.4	0	5.5	5.5	0	5.5	0	0.8	2.5	0	1.1	1.7	2.1	0	0	2	2.8
MU Trucks	1	0	2	0	3	0	20	0	0	20	0	3	13	0	16	1	11	0	0	12	51
% MU Trucks	0.3	0	0.4	0	0.3	0	1.7	0	0	1.3	0	0.2	4.6	0	0.9	0.2	0.6	0	0	0.5	0.8

Manual Turning Movement Count

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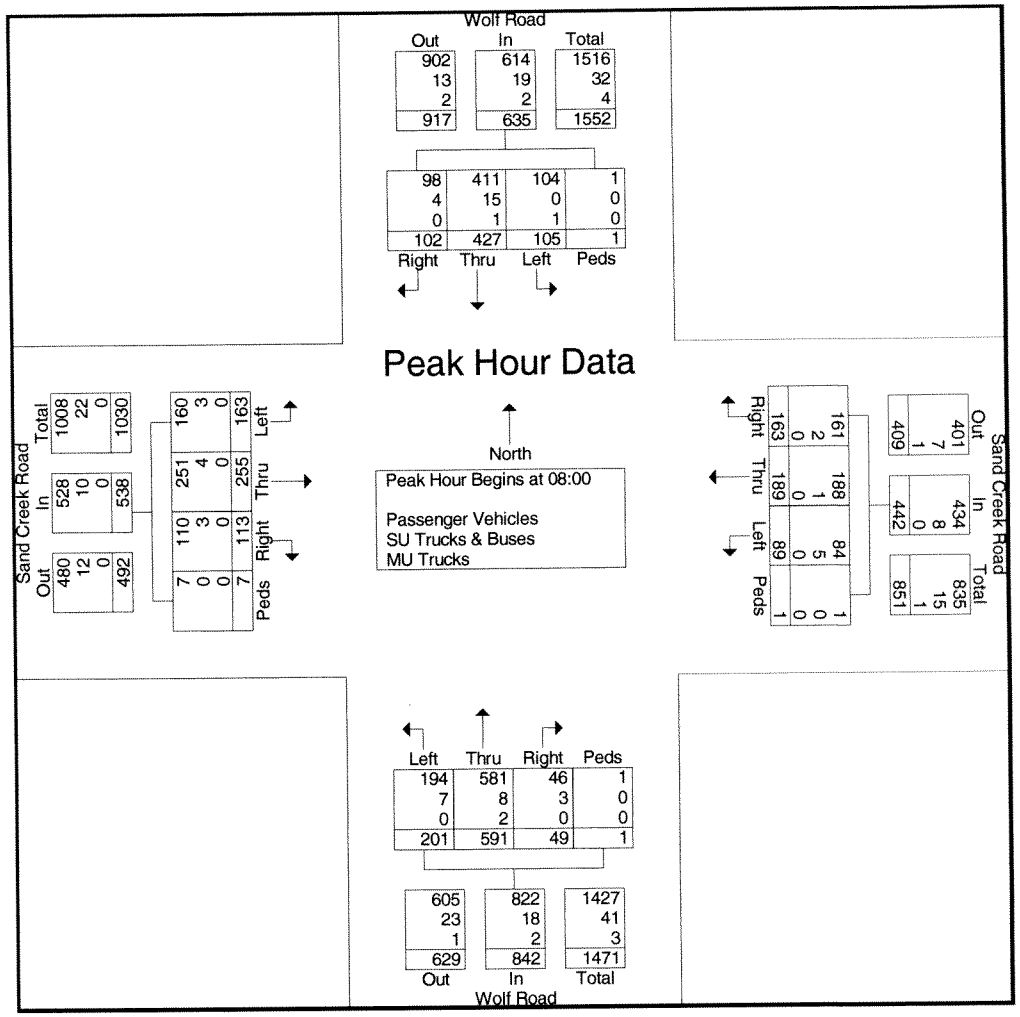
Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
AM
7 to 9

File Name : Wolf - Sand Creek AM
Site Code : 62806005
Start Date : 6/28/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
AM
7 to 9

File Name : Wolf - Sand Creek AM
Site Code : 62806005
Start Date : 6/28/2006
Page No : 3

	Wolf Road Southbound					Sand Creek Road Westbound					Wolf Road Northbound					Sand Creek Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00																					
08:00	19	**118**				**25**							**15**			**45**		**37**		**151**	**636**
08:15	20	96	23	0	139	18	45	37	0	100	56	**156**	10	0	**222**	43	55	34	0	132	593
08:30	**33**	113	**31**	**1**	**178**	24	42	41	**1**	108	41	156	15	**1**	213	34	**69**	25	**3**	131	630
08:45	33	100	27	0	160	22	**56**	**45**	0	**123**	**58**	124	9	0	191	41	64	17	2	124	598
Total Volume	105	427	102	1	635	89	189	163	1	442	201	591	49	1	842	163	255	113	7	538	2457
% App. Total	16.5	67.2	16.1	0.2		20.1	42.8	36.9	0.2		23.9	70.2	5.8	0.1		30.3	47.4	21	1.3		
PHF	.795	.905	.823	.250	.892	.890	.844	.906	.250	.898	.866	.947	.817	.250	.948	.906	.924	.764	.583	.891	.966
Passenger Vehicles	104	411	98	1	614	84	188	161	1	434	194	581	46	1	822	160	251	110	7	528	2398
% Passenger Vehicles	99.0	96.3	96.1	100	96.7	94.4	99.5	98.8	100	98.2	96.5	98.3	93.9	100	97.6	98.2	98.4	97.3	100	98.1	97.6
SU Trucks & Buses	0	15	4	0	19	5	1	2	0	8	7	8	3	0	18	3	4	3	0	10	55
% SU Trucks & Buses	0	3.5	3.9	0	3.0	5.6	0.5	1.2	0	1.8	3.5	1.4	6.1	0	2.1	1.8	1.6	2.7	0	1.9	2.2
MU Trucks	1	1	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
% MU Trucks	1.0	0.2	0	0	0.3	0	0	0	0	0	0	0.3	0	0	0.2	0	0	0	0	0	0.2

Manual Turning Movement Count

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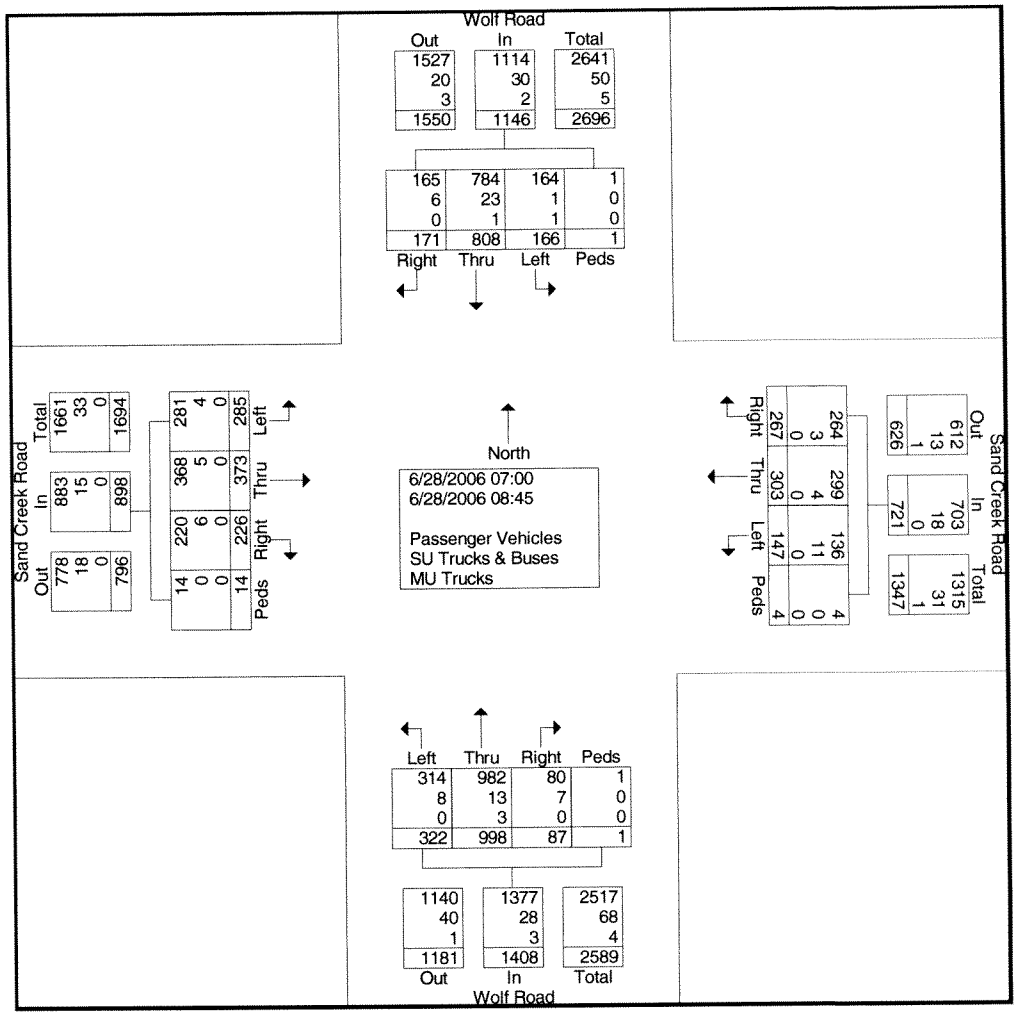
Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
AM
7 to 9

File Name : Wolf - Sand Creek AM
Site Code : 62806005
Start Date : 6/28/2006
Page No : 2



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Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
AM
7 to 9

File Name : Wolf - Sand Creek AM
Site Code : 62806005
Start Date : 6/28/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Sand Creek Road Westbound					Wolf Road Northbound					Sand Creek Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	11	71	11	0	93	14	18	26	2	60	19	80	17	0	116	21	27	25	1	74	343
07:15	12	93	11	0	116	12	20	22	0	54	20	97	6	0	123	26	15	23	0	64	357
07:30	17	112	26	0	155	7	29	28	0	64	34	109	6	0	149	29	35	26	3	93	461
07:45	21	105	21	0	147	25	47	28	1	101	48	121	9	0	178	46	41	39	3	129	555
Total	61	381	69	0	511	58	114	104	3	279	121	407	38	0	566	122	118	113	7	360	1716
08:00	19	118	21	0	158	25	46	40	0	111	46	155	15	0	216	45	67	37	2	151	636
08:15	20	96	23	0	139	18	45	37	0	100	56	156	10	0	222	43	55	34	0	132	593
08:30	33	113	31	1	178	24	42	41	1	108	41	156	15	1	213	34	69	25	3	131	630
08:45	33	100	27	0	160	22	56	45	0	123	58	124	9	0	191	41	64	17	2	124	598
Total	105	427	102	1	635	89	189	163	1	442	201	591	49	1	842	163	255	113	7	538	2457
Grand Total	166	808	171	1	1146	147	303	267	4	721	322	998	87	1	1408	285	373	226	14	898	4173
Apprch %	14.5	70.5	14.9	0.1		20.4	42	37	0.6		22.9	70.9	6.2	0.1		31.7	41.5	25.2	1.6		
Total %	4	19.4	4.1	0	27.5	3.5	7.3	6.4	0.1	17.3	7.7	23.9	2.1	0	33.7	6.8	8.9	5.4	0.3	21.5	
Passenger Vehicles																					
% Passenger Vehicles	98.8	97	96.5	100	97.2	92.5	98.7	98.9	100	97.5	97.5	98.4	92	100	97.8	98.6	98.7	97.3	100	98.3	97.7
SU Trucks & Buses	1	23	6	0	30	11	4	3	0	18	8	13	7	0	28	4	5	6	0	15	91
% SU Trucks & Buses	0.6	2.8	3.5	0	2.6	7.5	1.3	1.1	0	2.5	2.5	1.3	8	0	2	1.4	1.3	2.7	0	1.7	2.2
MU Trucks	1	1	0	0	2	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	5
% MU Trucks	0.6	0.1	0	0	0.2	0	0	0	0	0	0	0.3	0	0	0.2	0	0	0	0	0	0.1

Manual Turning Movement Count

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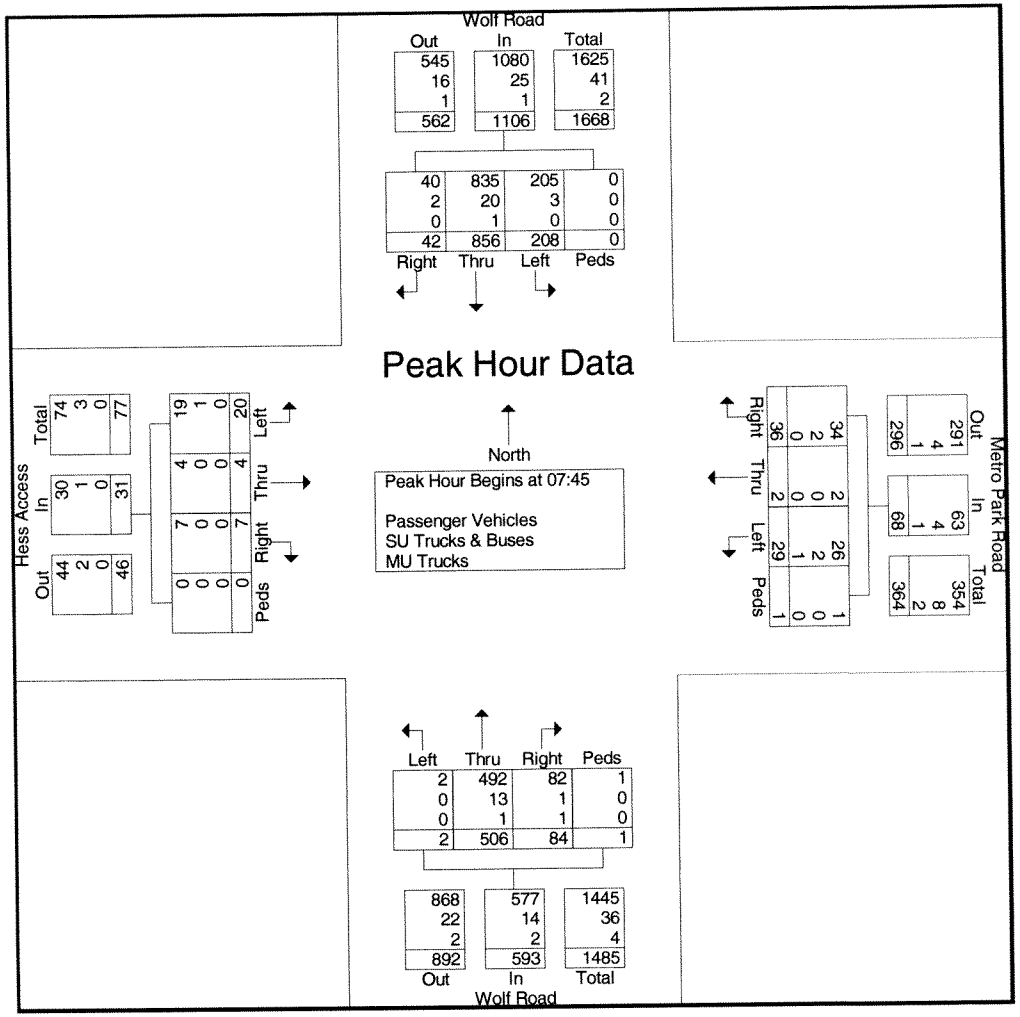
Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
AM
7 to 9

File Name : Wolf - Metro Park AM
Site Code : 62806003
Start Date : 6/28/2006
Page No : 4



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Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
AM
7 to 9

File Name : Wolf - Metro Park AM
Site Code : 62806003
Start Date : 6/28/2006
Page No : 3

	Wolf Road Southbound					Metro Park Road Westbound					Wolf Road Northbound					Hess Access Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	43	204	10	0	257	**10**				**19**						**6**	**1**	**3**		**10**	
08:00	56	211	11	0	278	6	**1**	6	0	13	**2**	126	21	0	149	3	1	1	0	5	445
08:15	**60**	208	**12**	0	280	5	1	**11**	0	17	0	127	**24**	0	**151**	6	1	3	0	10	458
08:30	49	**233**	9	0	**291**	8	0	10	**1**	19	0	**130**	18	**1**	149	5	1	0	0	6	**465**
Total Volume	208	856	42	0	1106	29	2	36	1	68	2	506	84	1	593	20	4	7	0	31	1798
% App. Total	18.8	77.4	3.8	0		42.6	2.9	52.9	1.5		0.3	85.3	14.2	0.2		64.5	12.9	22.6	0		
PHF	.867	.918	.875	.000	.950	.725	.500	.818	.250	.895	.250	.973	.875	.250	.982	.833	1.000	.583	.000	.775	.967
Passenger Vehicles	205	835	40	0	1080	26	2	34	1	63	2	492	82	1	577	19	4	7	0	30	1750
% Passenger Vehicles	98.6	97.5	95.2	0	97.6	89.7	100	94.4	100	92.6	100	97.2	97.6	100	97.3	95.0	100	100	0	96.8	97.3
SU Trucks & Buses	3	20	2	0	25	2	0	2	0	4	0	13	1	0	14	1	0	0	0	1	44
% SU Trucks & Buses	1.4	2.3	4.8	0	2.3	6.9	0	5.6	0	5.9	0	2.6	1.2	0	2.4	5.0	0	0	0	3.2	2.4
MU Trucks	0	1	0	0	1	1	0	0	0	1	0	1	1	0	2	0	0	0	0	0	4
% MU Trucks	0	0.1	0	0	0.1	3.4	0	0	0	1.5	0	0.2	1.2	0	0.3	0	0	0	0	0	0.2

Manual Turning Movement Count

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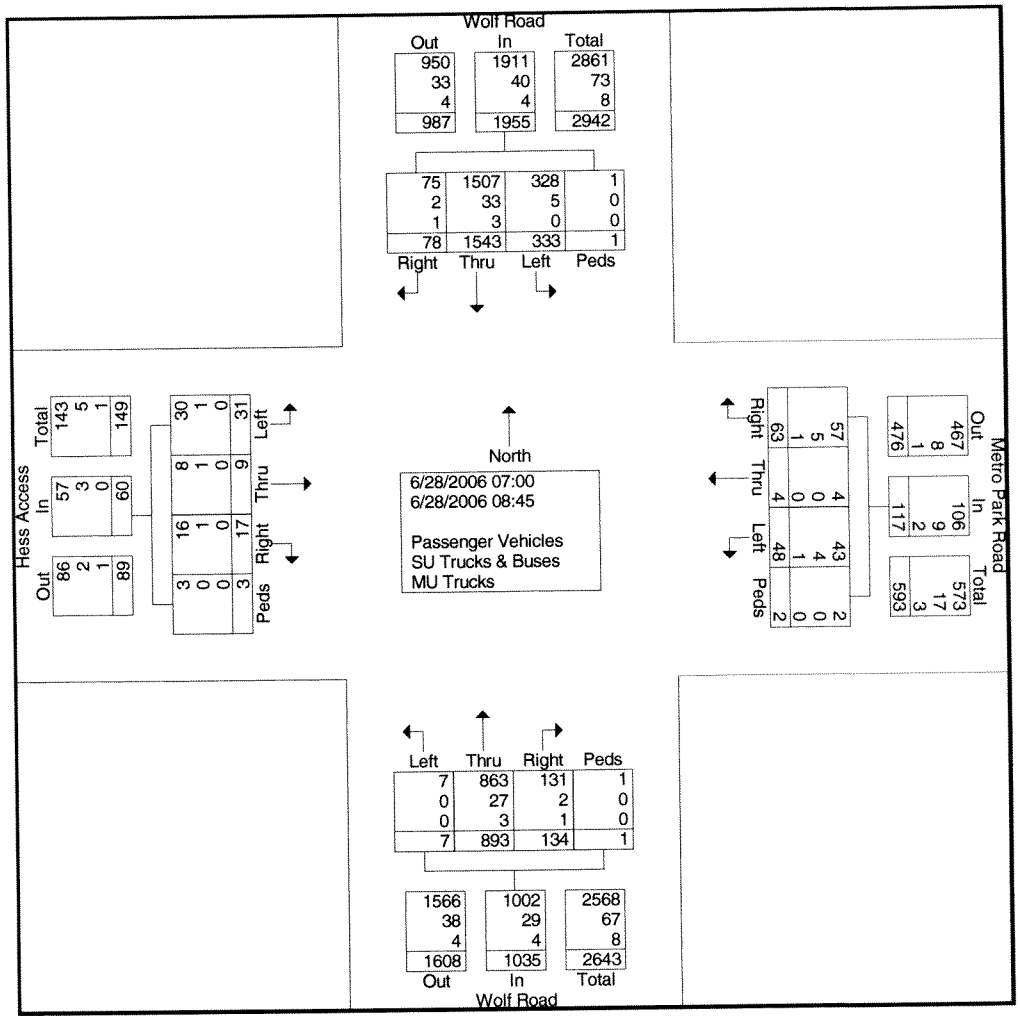
Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
AM
7 to 9

File Name : Wolf - Metro Park AM
Site Code : 62806003
Start Date : 6/28/2006
Page No : 2



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Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
AM
7 to 9

File Name : Wolf - Metro Park AM
Site Code : 62806003
Start Date : 6/28/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Metro Park Road Westbound					Wolf Road Northbound					Hess Access Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	24	124	10	1	159	1	1	5	0	7	0	67	6	0	73	6	2	2	0	10	249
07:15	27	161	12	0	200	4	0	4	1	9	2	88	7	0	97	1	0	3	0	4	310
07:30	36	204	5	0	245	4	0	7	0	11	0	113	15	0	128	2	1	0	2	5	389
07:45	43	204	10	0	257	10	0	9	0	19	0	123	21	0	144	6	1	3	0	10	430
Total	130	693	37	1	861	19	1	25	1	46	2	391	49	0	442	15	4	8	2	29	1378
08:00	56	211	11	0	278	6	1	6	0	13	2	126	21	0	149	3	1	1	0	5	445
08:15	60	208	12	0	280	5	1	11	0	17	0	127	24	0	151	6	1	3	0	10	458
08:30	49	233	9	0	291	8	0	10	1	19	0	130	18	1	149	5	1	0	0	6	465
08:45	38	198	9	0	245	10	1	11	0	22	3	119	22	0	144	2	2	5	1	10	421
Total	203	850	41	0	1094	29	3	38	1	71	5	502	85	1	593	16	5	9	1	31	1789
Grand Total	333	1543	78	1	1955	48	4	63	2	117	7	893	134	1	1035	31	9	17	3	60	3167
Apprch %	17	78.9	4	0.1		41	3.4	53.8	1.7		0.7	86.3	12.9	0.1		51.7	15	28.3	5		
Total %	10.5	48.7	2.5	0	61.7	1.5	0.1	2	0.1	3.7	0.2	28.2	4.2	0	32.7	1	0.3	0.5	0.1	1.9	
Passenger Vehicles																					
% Passenger Vehicles	98.5	97.7	96.2	100	97.7	89.6	100	90.5	100	90.6	100	96.6	97.8	100	96.8	96.8	88.9	94.1	100	95	97.1
SU Trucks & Buses	5	33	2	0	40	4	0	5	0	9	0	27	2	0	29	1	1	1	0	3	81
% SU Trucks & Buses	1.5	2.1	2.6	0	2	8.3	0	7.9	0	7.7	0	3	1.5	0	2.8	3.2	11.1	5.9	0	5	2.6
MU Trucks	0	3	1	0	4	1	0	1	0	2	0	3	1	0	4	0	0	0	0	0	10
% MU Trucks	0	0.2	1.3	0	0.2	2.1	0	1.6	0	1.7	0	0.3	0.7	0	0.4	0	0	0	0	0	0.3

Manual Turning Movement Count

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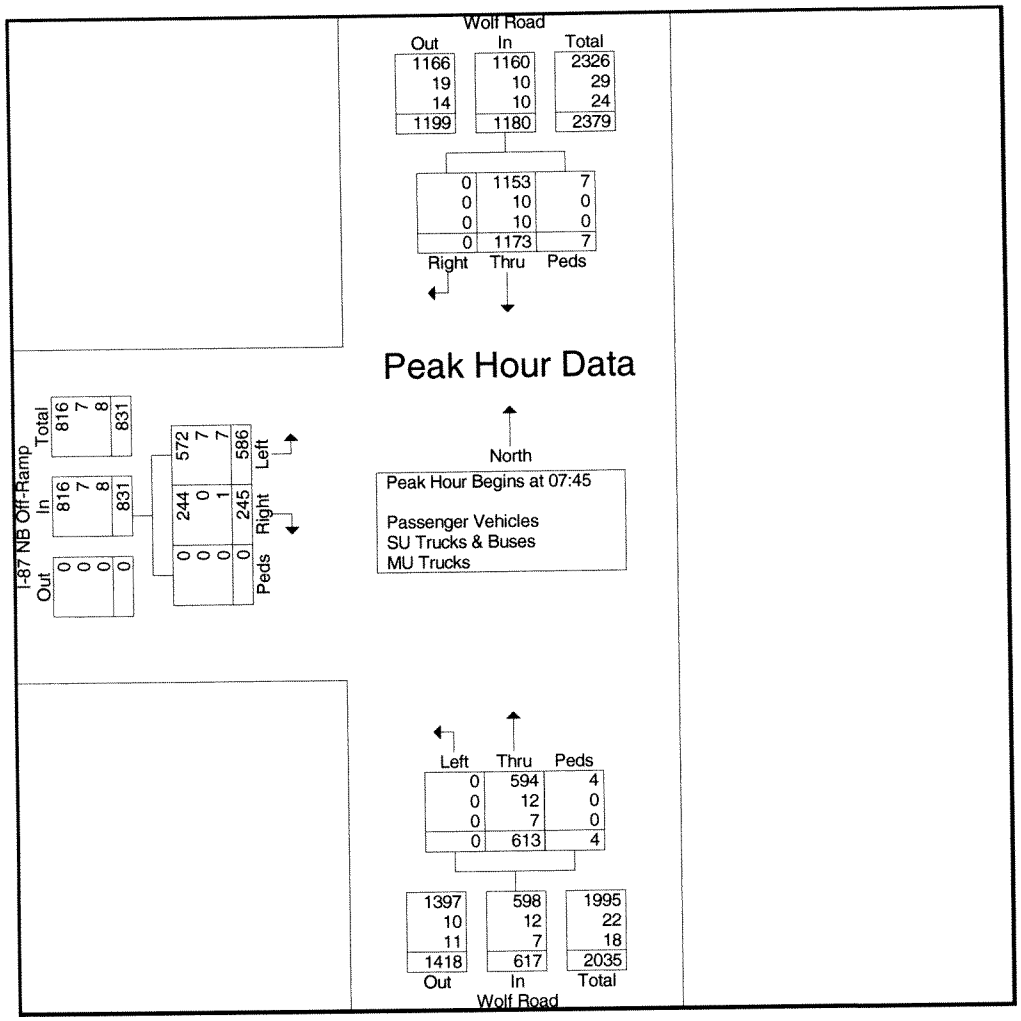
Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
AM
7 to 9

File Name : Wolf - Exit 4 NB Off-Ramp AM
Site Code : 71106001
Start Date : 7/11/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
AM
7 to 9

File Name : Wolf - Exit 4 NB Off-Ramp AM
Site Code : 71106001
Start Date : 7/11/2006
Page No : 3

	Wolf Road Southbound					Wolf Road Northbound					I-87 NB Off-Ramp Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	0	**319**		**5**	**324**							**168**		**4**	**172**	**156**				**219**	**715**
08:00	0	294	0	0	294	0	0	0	0	0	0	144	0	0	144	144	0	62	0	206	644
08:15	0	285	0	0	285	0	0	0	0	0	0	153	0	0	153	144	0	**69**	0	213	651
08:30	0	275	0	2	277	0	0	0	0	0	0	148	0	0	148	142	**2**	51	0	195	620
Total Volume	0	1173	0	7	1180	0	0	0	0	0	0	613	0	4	617	586	2	245	0	833	2630
% App. Total	0	99.4	0	0.6		0	0	0	0		0	99.4	0	0.6		70.3	0.2	29.4	0		
PHF	.000	.919	.000	.350	.910	.000	.000	.000	.000	.000	.000	.912	.000	.250	.897	.939	.250	.888	.000	.951	.920
Passenger Vehicles	0	1153	0	7	1160	0	0	0	0	0	0	594	0	4	598	572	2	244	0	818	2576
% Passenger Vehicles	0	98.3	0	100	98.3	0	0	0	0	0	0	96.9	0	100	96.9	97.6	100	99.6	0	98.2	97.9
SU Trucks & Buses	0	10	0	0	10	0	0	0	0	0	0	12	0	0	12	7	0	0	0	7	29
% SU Trucks & Buses	0	0.9	0	0	0.8	0	0	0	0	0	0	2.0	0	0	1.9	1.2	0	0	0	0.8	1.1
MU Trucks	0	10	0	0	10	0	0	0	0	0	0	7	0	0	7	7	0	1	0	8	25
% MU Trucks	0	0.9	0	0	0.8	0	0	0	0	0	0	1.1	0	0	1.1	1.2	0	0.4	0	1.0	1.0

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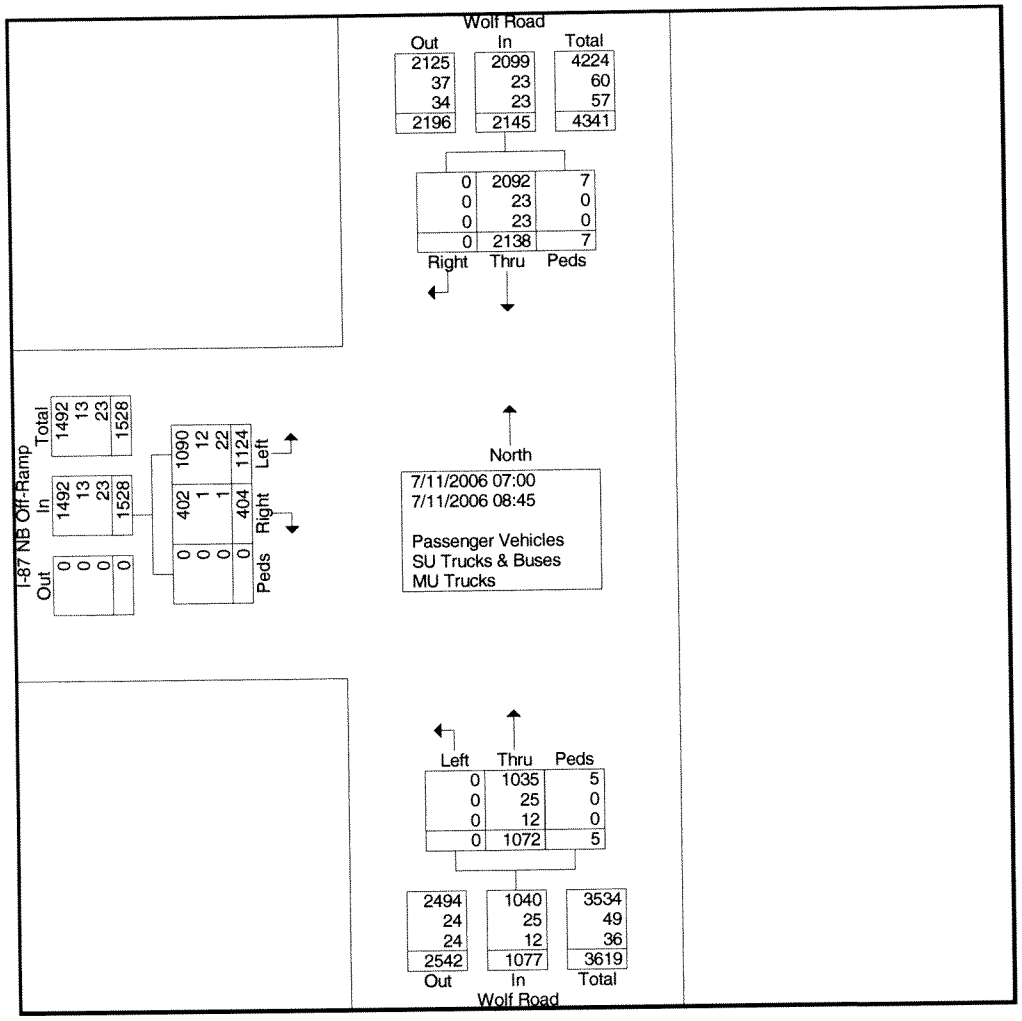
Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
AM
7 to 9

File Name : Wolf - Exit 4 NB Off-Ramp AM
Site Code : 71106001
Start Date : 7/11/2006
Page No : 2



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Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
AM
7 to 9

File Name : Wolf - Exit 4 NB Off-Ramp AM
Site Code : 71106001
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Wolf Road Northbound					I-87 NB Off-Ramp Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	0	189	0	0	189	0	0	0	0	0	0	85	0	0	85	114	0	21	0	135	409
07:15	0	251	0	0	251	0	0	0	0	0	0	109	0	0	109	126	0	42	0	168	528
07:30	0	254	0	0	254	0	0	0	0	0	0	105	0	0	105	146	0	46	0	192	551
07:45	0	319	0	5	324	0	0	0	0	0	0	168	0	4	172	156	0	63	0	219	715
Total	0	1013	0	5	1018	0	0	0	0	0	0	467	0	4	471	542	0	172	0	714	2203
08:00	0	294	0	0	294	0	0	0	0	0	0	144	0	0	144	144	0	62	0	206	644
08:15	0	285	0	0	285	0	0	0	0	0	0	153	0	0	153	144	0	69	0	213	651
08:30	0	275	0	2	277	0	0	0	0	0	0	148	0	0	148	142	2	51	0	195	620
08:45	0	271	0	0	271	0	0	0	0	0	0	160	0	1	161	152	0	50	0	202	634
Total	0	1125	0	2	1127	0	0	0	0	0	0	605	0	1	606	582	2	232	0	816	2549
Grand Total	0	2138	0	7	2145	0	0	0	0	0	0	1072	0	5	1077	1124	2	404	0	1530	4752
Apprch %	0	99.7	0	0.3		0	0	0	0		0	99.5	0	0.5		73.5	0.1	26.4	0		
Total %	0	45	0	0.1	45.1	0	0	0	0	0	0	22.6	0	0.1	22.7	23.7	0	8.5	0	32.2	
Passenger Vehicles	0	97.8	0	100	97.9	0	0	0	0	0	0	96.5	0	100	96.6	97	100	99.5	0	97.6	97.5
% Passenger Vehicles																					
SU Trucks & Buses	0	23	0	0	23	0	0	0	0	0	0	25	0	0	25	12	0	1	0	13	61
% SU Trucks & Buses	0	1.1	0	0	1.1	0	0	0	0	0	0	2.3	0	0	2.3	1.1	0	0.2	0	0.8	1.3
MU Trucks	0	23	0	0	23	0	0	0	0	0	0	12	0	0	12	22	0	1	0	23	58
% MU Trucks	0	1.1	0	0	1.1	0	0	0	0	0	0	1.1	0	0	1.1	2	0	0.2	0	1.5	1.2

Manual Turning Movement Count

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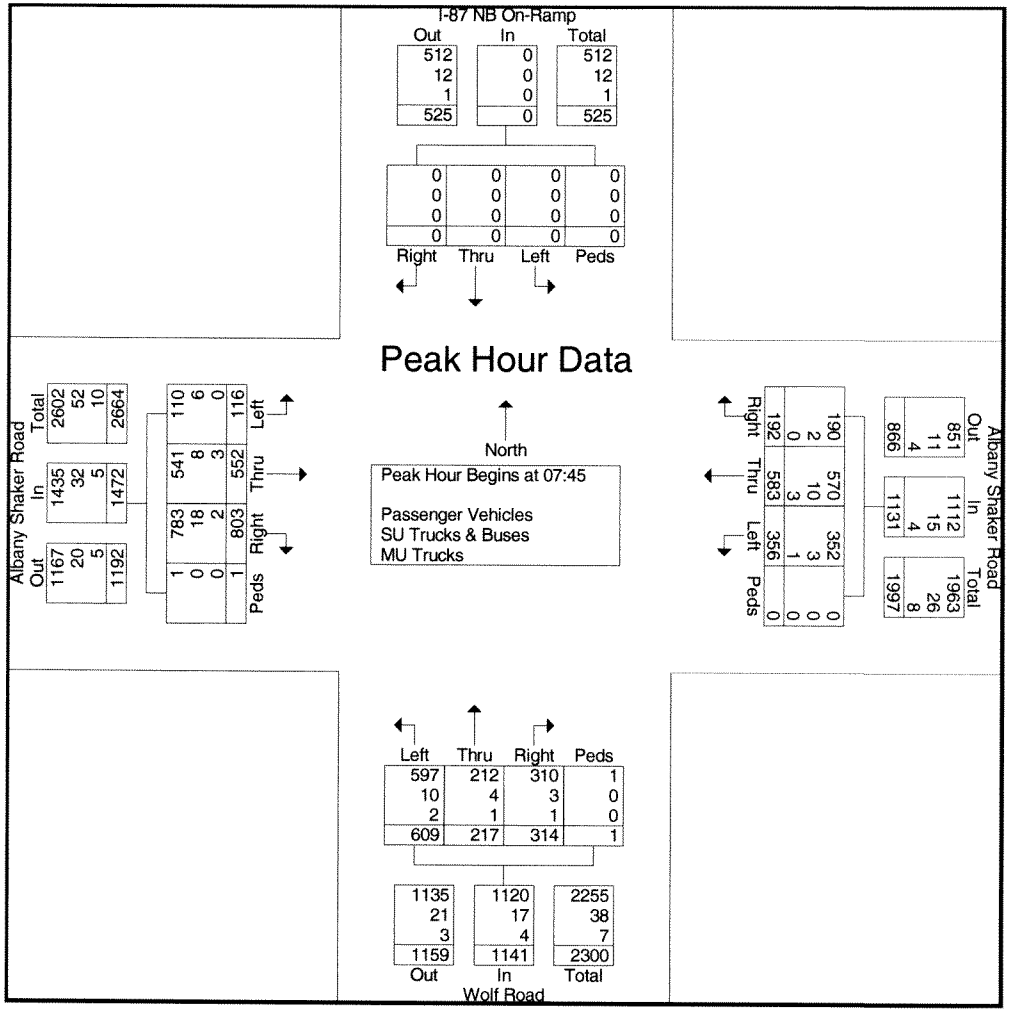
Exit 3 Airport Connector
Wolf Rd & Albany Shaker
AM
7 to 9

File Name : Albany Shaker - Wolf AM
Site Code : 07116005
Start Date : 7/11/2006
Page No : 4



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Exit 3 Airport Connector
Wolf Rd & Albany Shaker
AM
7 to 9

File Name : Albany Shaker - Wolf AM
Site Code : 07116005
Start Date : 7/11/2006
Page No : 3

	I-87 NB On-Ramp Southbound					Albany Shaker Road Westbound					Wolf Road Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	0	0	0	0	0	95	**176**			**323**								**213**			**980**
08:00	0	0	0	0	0	77	134	50	0	261	**163**	48	82	**1**	**294**	20	**150**	212	0	**382**	937
08:15	0	0	0	0	0	**105**	136	**53**	0	294	154	54	**85**	0	293	28	141	182	0	351	938
08:30	0	0	0	0	0	79	137	37	0	253	141	**61**	63	0	265	**43**	131	196	**1**	371	889
Total Volume	0	0	0	0	0	356	583	192	0	1131	609	217	314	1	1141	116	552	803	1	1472	3744
% App. Total	0	0	0	0		31.5	51.5	17	0		53.4	19	27.5	0.1		7.9	37.5	54.6	0.1		
PHF	.000	.000	.000	.000	.000	.848	.828	.906	.000	.875	.934	.889	.924	.250	.970	.674	.920	.942	.250	.963	.955
Passenger Vehicles	0	0	0	0	0	352	570	190	0	1112	597	212	310	1	1120	110	541	783	1	1435	3667
% Passenger Vehicles	0	0	0	0	0	98.9	97.8	99.0	0	98.3	98.0	97.7	98.7	100	98.2	94.8	98.0	97.5	100	97.5	97.9
SU Trucks & Buses	0	0	0	0	0	3	10	2	0	15	10	4	3	0	17	6	8	18	0	32	64
% SU Trucks & Buses	0	0	0	0	0	0.8	1.7	1.0	0	1.3	1.6	1.8	1.0	0	1.5	5.2	1.4	2.2	0	2.2	1.7
MU Trucks	0	0	0	0	0	1	3	0	0	4	2	1	1	0	4	0	3	2	0	5	13
% MU Trucks	0	0	0	0	0	0.3	0.5	0	0	0.4	0.3	0.5	0.3	0	0.4	0	0.5	0.2	0	0.3	0.3

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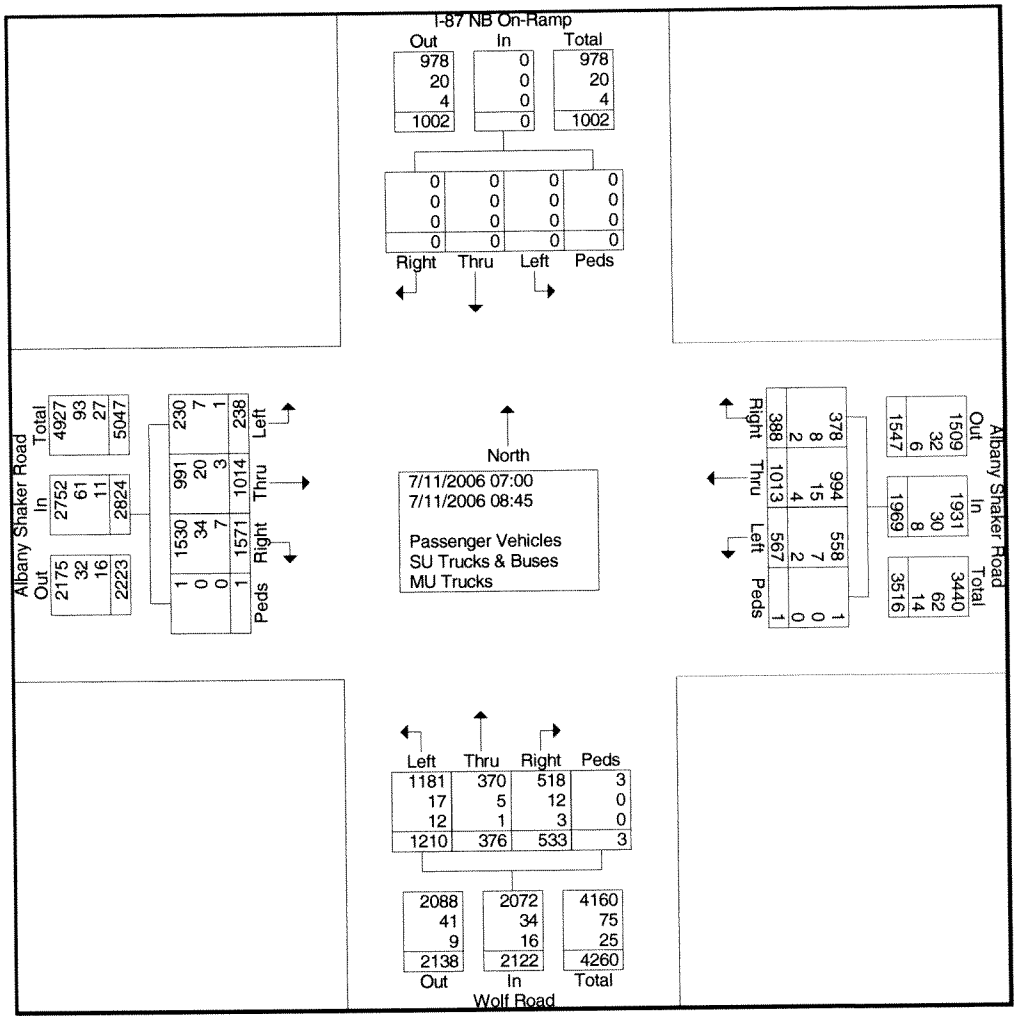
Exit 3 Airport Connector
Wolf Rd & Albany Shaker
AM
7 to 9

File Name : Albany Shaker - Wolf AM
Site Code : 07116005
Start Date : 7/11/2006
Page No : 2



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Exit 3 Airport Connector
Wolf Rd & Albany Shaker
AM
7 to 9

File Name : Albany Shaker - Wolf AM
Site Code : 07116005
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	I-87 NB On-Ramp Southbound					Albany Shaker Road Westbound					Wolf Road Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	0	0	0	0	0	43	74	31	0	148	119	30	38	0	187	36	100	147	0	283	618
07:15	0	0	0	0	0	49	103	46	0	198	153	34	45	0	232	22	111	206	0	339	769
07:30	0	0	0	0	0	51	133	64	1	249	150	26	52	1	229	28	137	201	0	366	844
07:45	0	0	0	0	0	95	176	52	0	323	151	54	84	0	289	25	130	213	0	368	980
Total	0	0	0	0	0	238	486	193	1	918	573	144	219	1	937	111	478	767	0	1356	3211
08:00	0	0	0	0	0	77	134	50	0	261	163	48	82	1	294	20	150	212	0	382	937
08:15	0	0	0	0	0	105	136	53	0	294	154	54	85	0	293	28	141	182	0	351	938
08:30	0	0	0	0	0	79	137	37	0	253	141	61	63	0	265	43	131	196	1	371	889
08:45	0	0	0	0	0	68	120	55	0	243	179	69	84	1	333	36	114	214	0	364	940
Total	0	0	0	0	0	329	527	195	0	1051	637	232	314	2	1185	127	536	804	1	1468	3704
Grand Total	0	0	0	0	0	567	1013	388	1	1969	1210	376	533	3	2122	238	1014	1571	1	2824	6915
Apprch %	0	0	0	0		28.8	51.4	19.7	0.1		57	17.7	25.1	0.1		8.4	35.9	55.6	0		
Total %	0	0	0	0	0	8.2	14.6	5.6	0	28.5	17.5	5.4	7.7	0	30.7	3.4	14.7	22.7	0	40.8	
Passenger Vehicles																					
% Passenger Vehicles	0	0	0	0	0	98.4	98.1	97.4	100	98.1	97.6	98.4	97.2	100	97.6	96.6	97.7	97.4	100	97.5	97.7
SU Trucks & Buses	0	0	0	0	0	7	15	8	0	30	17	5	12	0	34	7	20	34	0	61	125
% SU Trucks & Buses	0	0	0	0	0	1.2	1.5	2.1	0	1.5	1.4	1.3	2.3	0	1.6	2.9	2	2.2	0	2.2	1.8
MU Trucks	0	0	0	0	0	2	4	2	0	8	12	1	3	0	16	1	3	7	0	11	35
% MU Trucks	0	0	0	0	0	0.4	0.4	0.5	0	0.4	1	0.3	0.6	0	0.8	0.4	0.3	0.4	0	0.4	0.5

Manual Turning Movement Count

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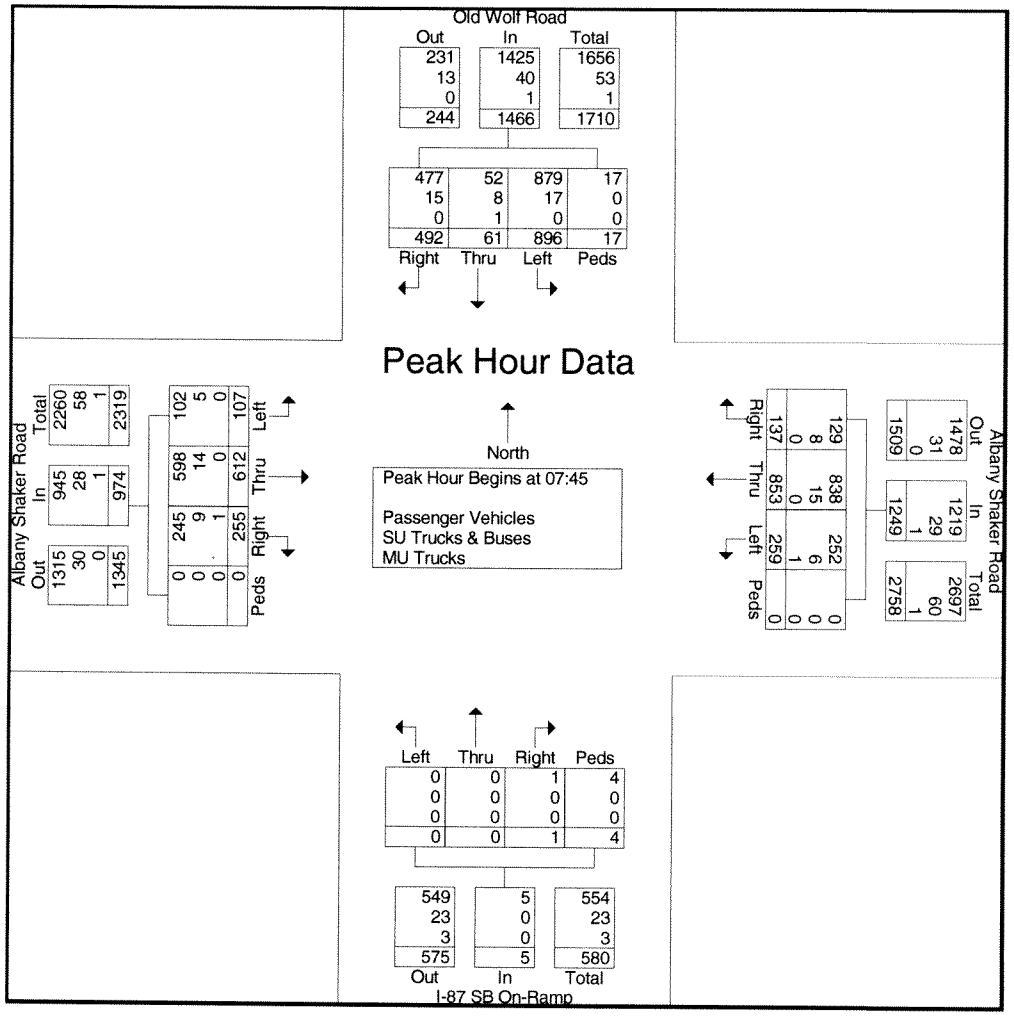
Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
AM
7 to 9

File Name : Albany Shaker - Old Wolf AM
Site Code : 71106003
Start Date : 7/11/2006
Page No : 4



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Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
AM
7 to 9

File Name : Albany Shaker - Old Wolf AM
Site Code : 71106003
Start Date : 7/11/2006
Page No : 3

	Old Wolf Road Southbound					Albany Shaker Road Westbound					I-87 SB On-Ramp Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	219	10	98	**16**		**75**	**235**			**329**						**37**	**175**			**271**	
08:00	**252**	10	**160**	0	**422**	63	220	33	0	316	0	0	**1**	**3**	**4**	22	131	56	0	209	**951**
08:15	217	11	122	0	350	70	210	31	0	311	0	0	0	0	0	23	143	**84**	0	250	911
08:30	208	**30**	112	1	351	51	188	**54**	0	293	0	0	0	1	1	25	163	56	0	244	889
Total Volume	896	61	492	17	1466	259	853	137	0	1249	0	0	1	4	5	107	612	255	0	974	3694
% App. Total	61.1	4.2	33.6	1.2		20.7	68.3	11	0		0	0	20	80		11	62.8	26.2	0		
PHF	.889	.508	.769	.266	.868	.863	.907	.634	.000	.949	.000	.000	.250	.333	.313	.723	.874	.759	.000	.899	.971
Passenger Vehicles	879	52	477	17	1425	252	838	129	0	1219	0	0	1	4	5	102	598	245	0	945	3594
% Passenger Vehicles	98.1	85.2	97.0	100	97.2	97.3	98.2	94.2	0	97.6	0	0	100	100	100	95.3	97.7	96.1	0	97.0	97.3
SU Trucks & Buses	17	8	15	0	40	6	15	8	0	29	0	0	0	0	0	5	14	9	0	28	97
% SU Trucks & Buses	1.9	13.1	3.0	0	2.7	2.3	1.8	5.8	0	2.3	0	0	0	0	0	4.7	2.3	3.5	0	2.9	2.6
MU Trucks	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	3
% MU Trucks	0	1.6	0	0	0.1	0.4	0	0	0	0.1	0	0	0	0	0	0	0	0.4	0	0.1	0.1

Manual Turning Movement Count

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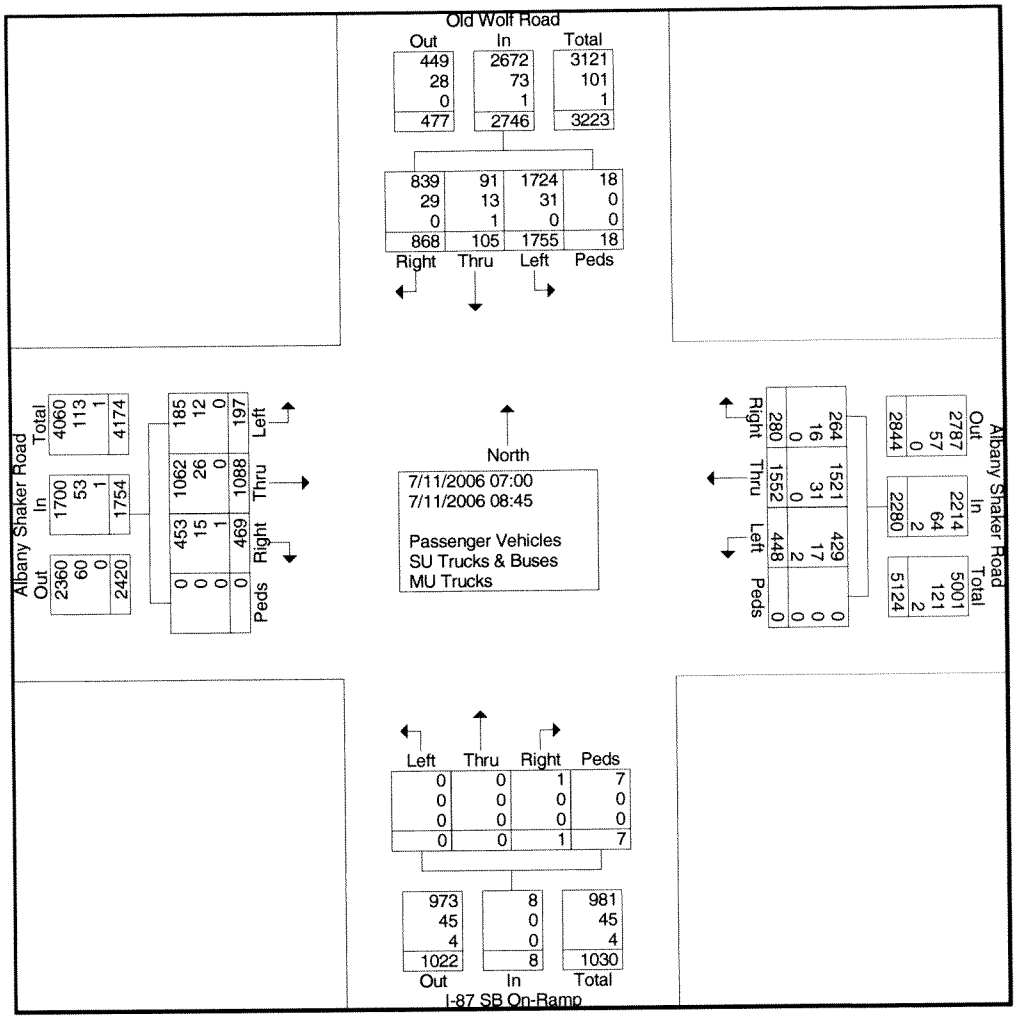
Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
AM
7 to 9

File Name : Albany Shaker - Old Wolf AM
Site Code : 71106003
Start Date : 7/11/2006
Page No : 2



Manual Turning Movement Count

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Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
AM
7 to 9

File Name : Albany Shaker - Old Wolf AM
Site Code : 71106003
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Old Wolf Road Southbound					Albany Shaker Road Westbound					I-87 SB On-Ramp Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	196	6	96	0	298	43	176	39	0	258	0	0	0	3	3	25	94	30	0	149	708
07:15	179	5	82	0	266	42	148	32	0	222	0	0	0	0	0	24	119	60	0	203	691
07:30	256	12	111	0	379	39	181	34	0	254	0	0	0	0	0	18	115	41	0	174	807
07:45	219	10	98	16	343	75	235	19	0	329	0	0	0	0	0	37	175	59	0	271	943
Total	850	33	387	16	1286	199	740	124	0	1063	0	0	0	3	3	104	503	190	0	797	3149
08:00	252	10	160	0	422	63	220	33	0	316	0	0	1	3	4	22	131	56	0	209	951
08:15	217	11	122	0	350	70	210	31	0	311	0	0	0	0	0	23	143	84	0	250	911
08:30	208	30	112	1	351	51	188	54	0	293	0	0	0	1	1	25	163	56	0	244	889
08:45	228	21	87	1	337	65	194	38	0	297	0	0	0	0	0	23	148	83	0	254	888
Total	905	72	481	2	1460	249	812	156	0	1217	0	0	1	4	5	93	585	279	0	957	3639
Grand Total	1755	105	868	18	2746	448	1552	280	0	2280	0	0	1	7	8	197	1088	469	0	1754	6788
Apprch %	63.9	3.8	31.6	0.7		19.6	68.1	12.3	0		0	0	12.5	87.5		11.2	62	26.7	0		
Total %	25.9	1.5	12.8	0.3	40.5	6.6	22.9	4.1	0	33.6	0	0	0	0.1	0.1	2.9	16	6.9	0	25.8	
Passenger Vehicles																					
% Passenger Vehicles	98.2	86.7	96.7	100	97.3	95.8	98	94.3	0	97.1	0	0	100	100	100	93.9	97.6	96.6	0	96.9	97.1
SU Trucks & Buses	31	13	29	0	73	17	31	16	0	64	0	0	0	0	0	12	26	15	0	53	190
% SU Trucks & Buses	1.8	12.4	3.3	0	2.7	3.8	2	5.7	0	2.8	0	0	0	0	0	6.1	2.4	3.2	0	3	2.8
MU Trucks	0	1	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0	1	0	1	4
% MU Trucks	0	1	0	0	0	0.4	0	0	0	0.1	0	0	0	0	0	0	0	0.2	0	0.1	0.1

Manual Turning Movement Count

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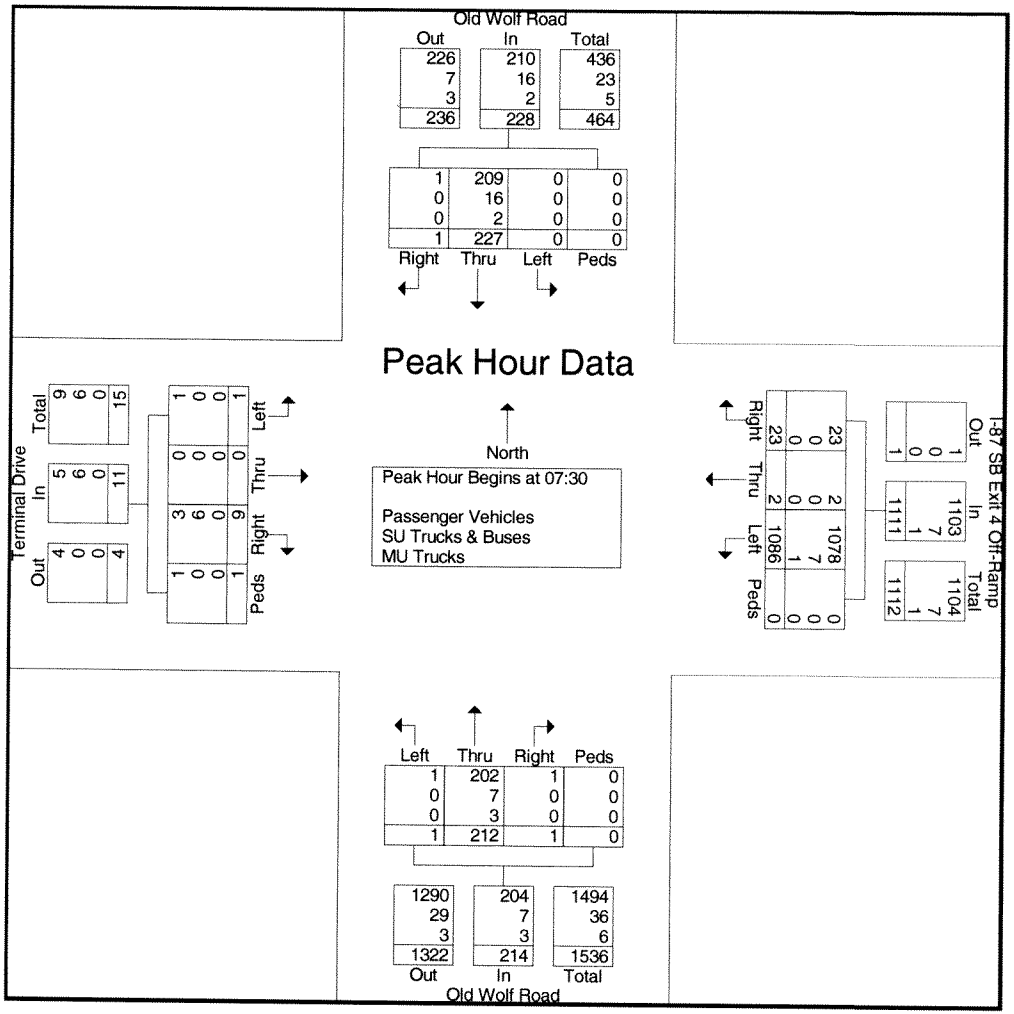
Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
AM
7 to 9

File Name : Old Wolf - Exit 4 SB AM
Site Code : 62906007
Start Date : 6/29/2006
Page No : 4



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Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
AM
7 to 9

File Name : Old Wolf - Exit 4 SB AM
Site Code : 62906007
Start Date : 6/29/2006
Page No : 3

	Old Wolf Road Southbound					I-87 SB Exit 4 Off-Ramp Westbound					Old Wolf Road Northbound					Terminal Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30																					
07:30	0	47	0	0	47	249	**1**	**6**			**1**		**1**								
07:45	0	59	0	0	59	279	1	6	0	286	0	**58**	0	0	**58**	0	0	**4**	0	**4**	**407**
08:00	0	**69**	**1**	0	**70**	277	0	5	0	282	0	52	0	0	52	**1**	0	0	**1**	2	406
08:15	0	52	0	0	52	**281**	0	6	0	**287**	0	52	0	0	52	0	0	2	0	2	393
Total Volume	0	227	1	0	228	1086	2	23	0	1111	1	212	1	0	214	1	0	9	1	11	1564
% App. Total	0	99.6	0.4	0		97.7	0.2	2.1	0		0.5	99.1	0.5	0		9.1	0	81.8	9.1		
PHF	.000	.822	.250	.000	.814	.966	.500	.958	.000	.968	.250	.914	.250	.000	.922	.250	.000	.563	.250	.688	.961
Passenger Vehicles	0	209	1	0	210	1078	2	23	0	1103	1	202	1	0	204	1	0	3	1	5	1522
% Passenger Vehicles	0	92.1	100	0	92.1	99.3	100	100	0	99.3	100	95.3	100	0	95.3	100	0	33.3	100	45.5	97.3
SU Trucks & Buses	0	16	0	0	16	7	0	0	0	7	0	7	0	0	7	0	0	6	0	6	36
% SU Trucks & Buses	0	7.0	0	0	7.0	0.6	0	0	0	0.6	0	3.3	0	0	3.3	0	0	66.7	0	54.5	2.3
MU Trucks	0	2	0	0	2	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	6
% MU Trucks	0	0.9	0	0	0.9	0.1	0	0	0	0.1	0	1.4	0	0	1.4	0	0	0	0	0	0.4

Manual Turning Movement Count

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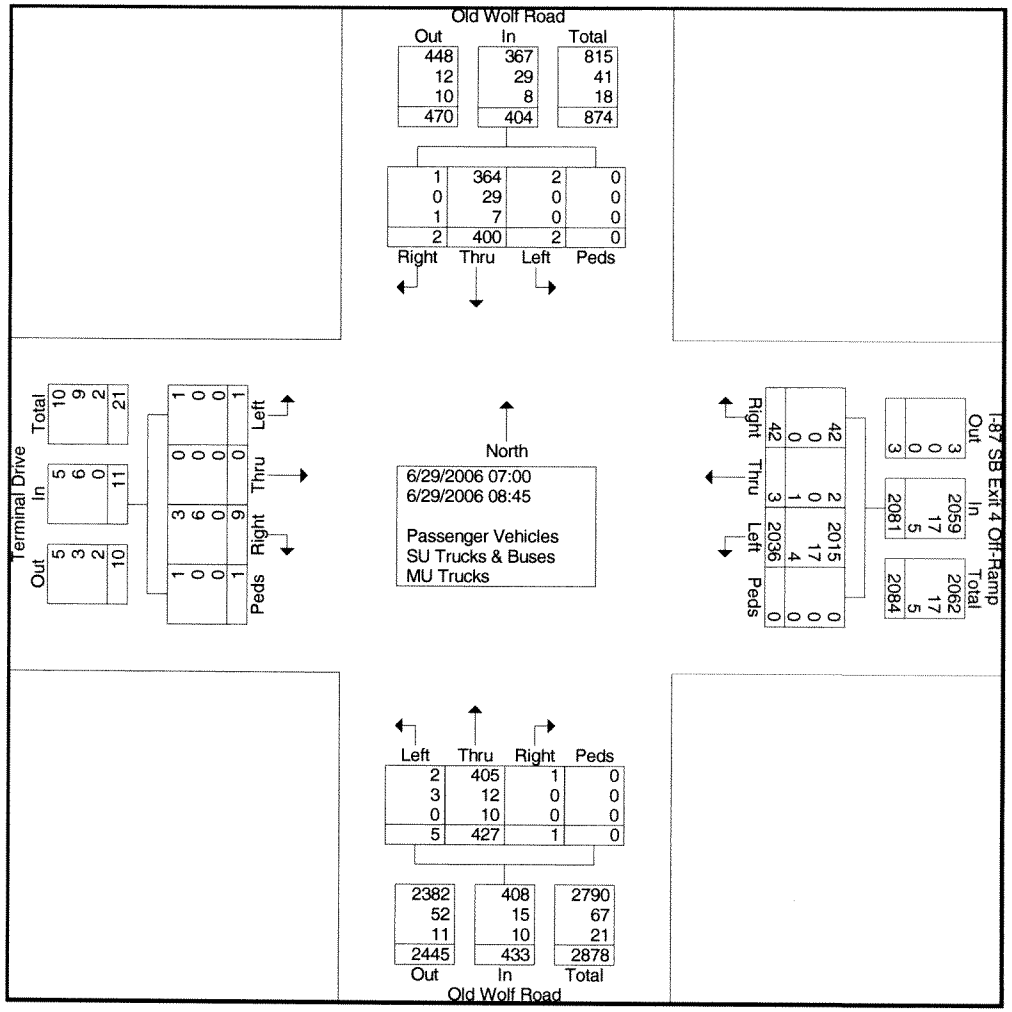
Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
AM
7 to 9

File Name : Old Wolf - Exit 4 SB AM
Site Code : 62906007
Start Date : 6/29/2006
Page No : 2



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Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
AM
7 to 9

File Name : Old Wolf - Exit 4 SB AM
Site Code : 62906007
Start Date : 6/29/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Old Wolf Road Southbound					I-87 SB Exit 4 Off-Ramp Westbound					Old Wolf Road Northbound					Terminal Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	0	36	0	0	36	201	1	7	0	209	2	63	0	0	65	0	0	0	0	0	310
07:15	0	27	0	0	27	254	0	4	0	258	0	47	0	0	47	0	0	0	0	0	332
07:30	0	47	0	0	47	249	1	6	0	256	1	50	1	0	52	0	0	3	0	3	358
07:45	0	59	0	0	59	279	1	6	0	286	0	58	0	0	58	0	0	4	0	4	407
Total	0	169	0	0	169	983	3	23	0	1009	3	218	1	0	222	0	0	7	0	7	1407
08:00	0	69	1	0	70	277	0	5	0	282	0	52	0	0	52	1	0	0	1	2	406
08:15	0	52	0	0	52	281	0	6	0	287	0	52	0	0	52	0	0	2	0	2	393
08:30	1	56	1	0	58	232	0	5	0	237	2	55	0	0	57	0	0	0	0	0	352
08:45	1	54	0	0	55	263	0	3	0	266	0	50	0	0	50	0	0	0	0	0	371
Total	2	231	2	0	235	1053	0	19	0	1072	2	209	0	0	211	1	0	2	1	4	1522
Grand Total	2	400	2	0	404	2036	3	42	0	2081	5	427	1	0	433	1	0	9	1	11	2929
Apprch %	0.5	99	0.5	0		97.8	0.1	2	0		1.2	98.6	0.2	0		9.1	0	81.8	9.1		
Total %	0.1	13.7	0.1	0	13.8	69.5	0.1	1.4	0	71	0.2	14.6	0	0	14.8	0	0	0.3	0	0.4	
Passenger Vehicles																					
% Passenger Vehicles	100	91	50	0	90.8	99	66.7	100	0	98.9	40	94.8	100	0	94.2	100	0	33.3	100	45.5	96.9
SU Trucks & Buses	0	29	0	0	29	17	0	0	0	17	3	12	0	0	15	0	0	6	0	6	67
% SU Trucks & Buses	0	7.2	0	0	7.2	0.8	0	0	0	0.8	60	2.8	0	0	3.5	0	0	66.7	0	54.5	2.3
MU Trucks	0	7	1	0	8	4	1	0	0	5	0	10	0	0	10	0	0	0	0	0	23
% MU Trucks	0	1.8	50	0	2	0.2	33.3	0	0	0.2	0	2.3	0	0	2.3	0	0	0	0	0	0.8

Manual Turning Movement Count

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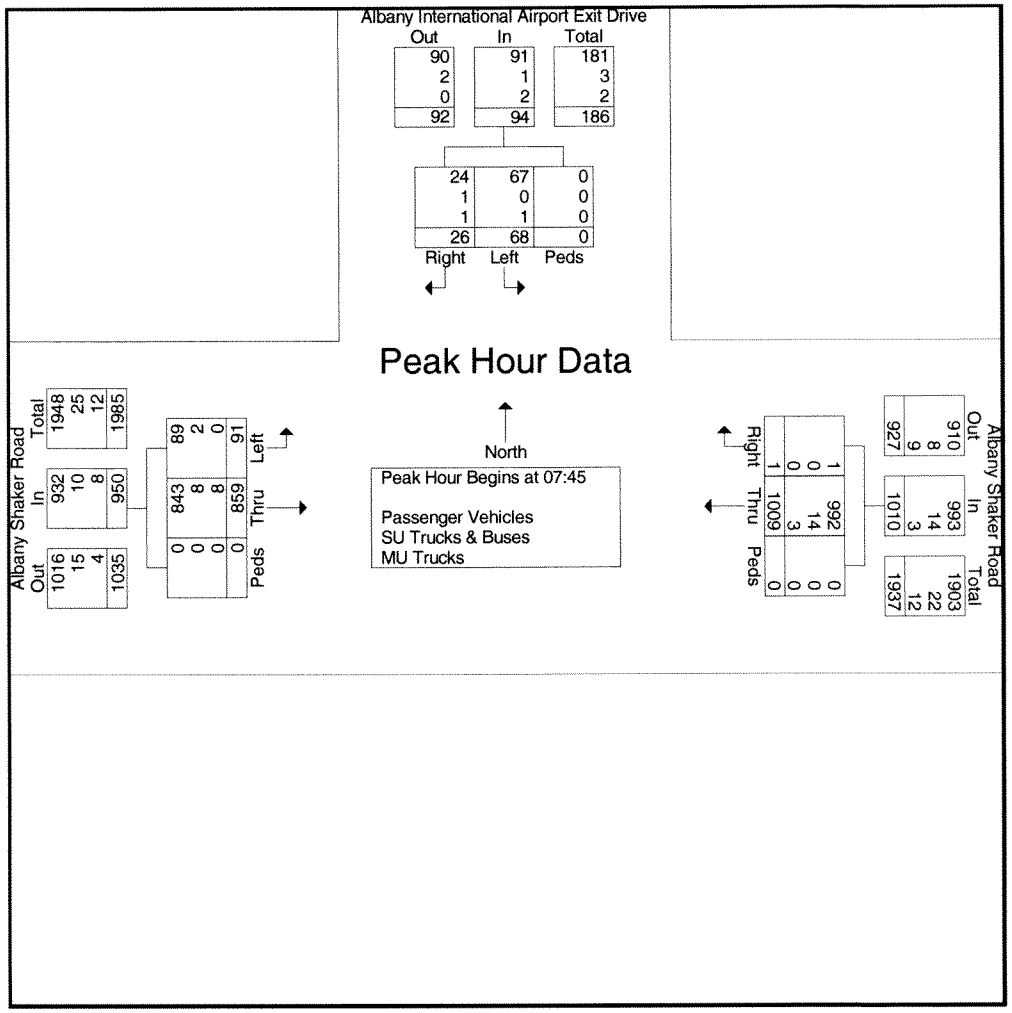
Exit 3 Airport Connector
Albany Shaker - Alb Int Terminal
AM
7 to 9

File Name : Albany Shaker - Alb Int Term Access AM
Site Code : 71106009
Start Date : 7/11/2006
Page No : 4



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Exit 3 Airport Connector
Albany Shaker - Alb Int Terminal
AM
7 to 9

File Name : Albany Shaker - Alb Int Term Access AM
Site Code : 71106009
Start Date : 7/11/2006
Page No : 3

	Albany International Airport Exit Drive Southbound					Albany Shaker Road Westbound					Albany Shaker Road Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	14	0	**10**					**1**								**27**					**540**
08:00	15	0	4	0	19	0	**285**	0	0	**285**	0	0	0	0	0	24	201	0	0	225	529
08:15	19	0	5	0	24	0	243	0	0	243	0	0	0	0	0	14	212	0	0	226	493
08:30	**20**	0	7	0	**27**	0	213	0	0	213	0	0	0	0	0	26	**226**	0	0	**252**	492
Total Volume	68	0	26	0	94	0	1009	1	0	1010	0	0	0	0	0	91	859	0	0	950	2054
% App. Total	72.3	0	27.7	0		0	99.9	0.1	0		0	0	0	0		9.6	90.4	0	0		
PHF	.850	.000	.650	.000	.870	.000	.885	.250	.000	.886	.000	.000	.000	.000	.000	.843	.950	.000	.000	.942	.951
Passenger Vehicles	67	0	24	0	91	0	992	1	0	993	0	0	0	0	0	89	843	0	0	932	2016
% Passenger Vehicles	98.5	0	92.3	0	96.8	0	98.3	100	0	98.3	0	0	0	0	0	97.8	98.1	0	0	98.1	98.1
SU Trucks & Buses	0	0	1	0	1	0	14	0	0	14	0	0	0	0	0	2	8	0	0	10	25
% SU Trucks & Buses	0	0	3.8	0	1.1	0	1.4	0	0	1.4	0	0	0	0	0	2.2	0.9	0	0	1.1	1.2
MU Trucks	1	0	1	0	2	0	3	0	0	3	0	0	0	0	0	0	8	0	0	8	13
% MU Trucks	1.5	0	3.8	0	2.1	0	0.3	0	0	0.3	0	0	0	0	0	0	0.9	0	0	0.8	0.6

Manual Turning Movement Count

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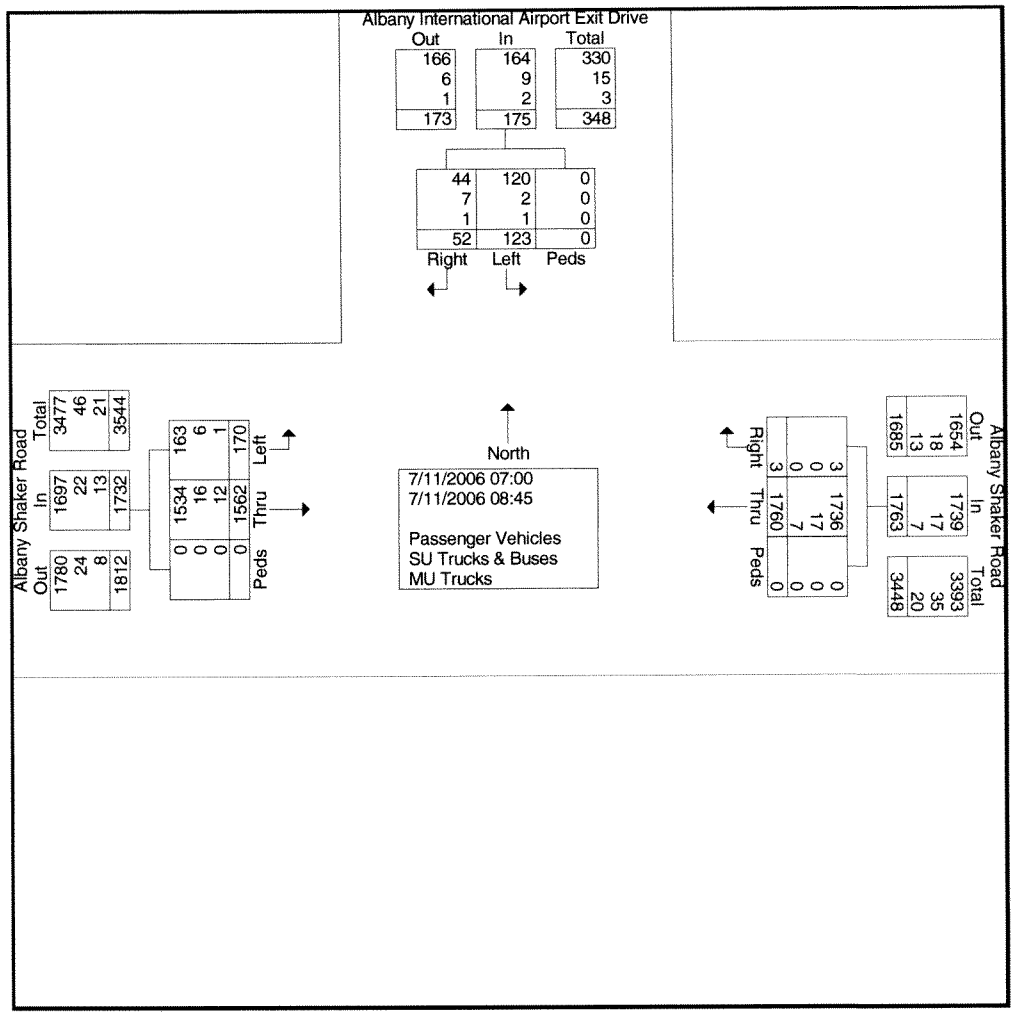
Exit 3 Airport Connector
Albany Shaker - Alb Int Terminal
AM
7 to 9

File Name : Albany Shaker - Alb Int Term Access AM
Site Code : 71106009
Start Date : 7/11/2006
Page No : 2



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Exit 3 Airport Connector
Albany Shaker - Alb Int Terminal
AM
7 to 9

File Name : Albany Shaker - Alb Int Term Access AM
Site Code : 71106009
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Albany International Airport Exit Drive Southbound					Albany Shaker Road Westbound					Albany Shaker Road Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00	23	0	8	0	31	0	148	0	0	148	0	0	0	0	0	16	142	0	0	158	337
07:15	10	0	11	0	21	0	165	1	0	166	0	0	0	0	0	26	176	0	0	202	389
07:30	11	0	4	0	15	0	231	0	0	231	0	0	0	0	0	16	170	0	0	186	432
07:45	14	0	10	0	24	0	268	1	0	269	0	0	0	0	0	27	220	0	0	247	540
Total	58	0	33	0	91	0	812	2	0	814	0	0	0	0	0	85	708	0	0	793	1698
08:00	15	0	4	0	19	0	285	0	0	285	0	0	0	0	0	24	201	0	0	225	529
08:15	19	0	5	0	24	0	243	0	0	243	0	0	0	0	0	14	212	0	0	226	493
08:30	20	0	7	0	27	0	213	0	0	213	0	0	0	0	0	26	226	0	0	252	492
08:45	11	0	3	0	14	0	207	1	0	208	0	0	0	0	0	21	215	0	0	236	458
Total	65	0	19	0	84	0	948	1	0	949	0	0	0	0	0	85	854	0	0	939	1972
Grand Total	123	0	52	0	175	0	1760	3	0	1763	0	0	0	0	0	170	1562	0	0	1732	3670
Apprch %	70.3	0	29.7	0		0	99.8	0.2	0		0	0	0	0		9.8	90.2	0	0		
Total %	3.4	0	1.4	0	4.8	0	48	0.1	0	48	0	0	0	0	0	4.6	42.6	0	0	47.2	
Passenger Vehicles																					
% Passenger Vehicles	97.6	0	84.6	0	93.7	0	98.6	100	0	98.6	0	0	0	0	0	95.9	98.2	0	0	98	98.1
SU Trucks & Buses	2	0	7	0	9	0	17	0	0	17	0	0	0	0	0	6	16	0	0	22	48
% SU Trucks & Buses	1.6	0	13.5	0	5.1	0	1	0	0	1	0	0	0	0	0	3.5	1	0	0	1.3	1.3
MU Trucks	1	0	1	0	2	0	7	0	0	7	0	0	0	0	0	1	12	0	0	13	22
% MU Trucks	0.8	0	1.9	0	1.1	0	0.4	0	0	0.4	0	0	0	0	0	0.6	0.8	0	0	0.8	0.6

Manual Turning Movement Count

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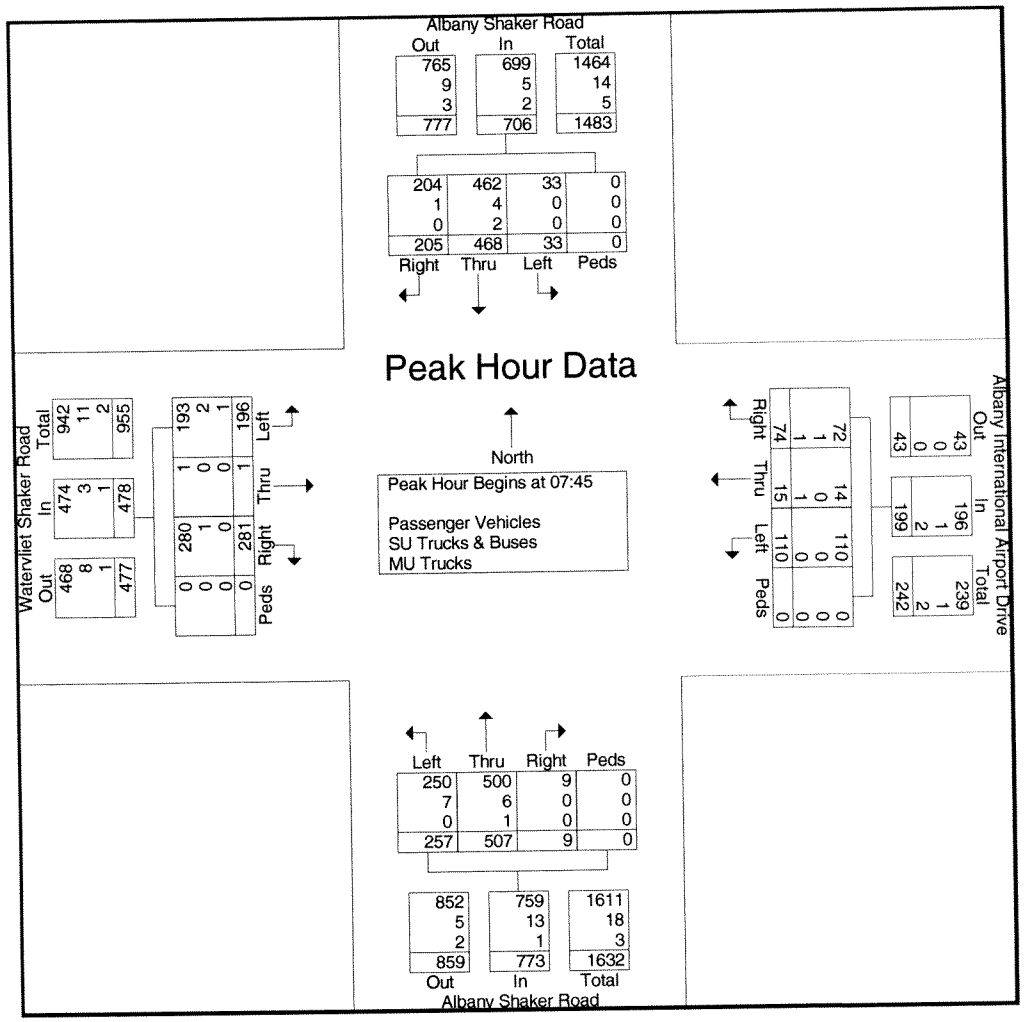
Exit 3 Airport Connector
Albany Shaker & Watervliet Shaker
AM
7 to 9

File Name : Albany Shaker - Watervliet Shaker AM
Site Code : 62806001
Start Date : 6/28/2006
Page No : 4



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Exit 3 Airport Connector
Albany Shaker & Watervliet Shaker
AM
7 to 9

File Name : Albany Shaker - Watervliet Shaker AM
Site Code : 62806001
Start Date : 6/28/2006
Page No : 3

	Albany Shaker Road Southbound					Albany International Airport Drive Westbound					Albany Shaker Road Northbound					Watervliet Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45																					
07:45	8	**123**					**6**									**52**		**75**		**127**	**558**
08:00	6	110	48	0	164	**35**	3	**25**	0	**63**	**69**	**146**	1	0	**216**	46	0	68	0	114	557
08:15	6	117	43	0	166	21	1	22	0	44	69	111	**3**	0	183	52	**1**	67	0	120	513
08:30	**13**	118	**62**	0	**193**	31	5	17	0	53	53	109	3	0	165	46	0	71	0	117	528
Total Volume	33	468	205	0	706	110	15	74	0	199	257	507	9	0	773	196	1	281	0	478	2156
% App. Total	4.7	66.3	29	0		55.3	7.5	37.2	0		33.2	65.6	1.2	0		41	0.2	58.8	0		
PHF	.635	.951	.827	.000	.915	.786	.625	.740	.000	.790	.931	.868	.750	.000	.895	.942	.250	.937	.000	.941	.966
Passenger Vehicles	33	462	204	0	699	110	14	72	0	196	250	500	9	0	759	193	1	280	0	474	2128
% Passenger Vehicles	100	98.7	99.5	0	99.0	100	93.3	97.3	0	98.5	97.3	98.6	100	0	98.2	98.5	100	99.6	0	99.2	98.7
SU Trucks & Buses	0	4	1	0	5	0	0	1	0	1	7	6	0	0	13	2	0	1	0	3	22
% SU Trucks & Buses	0	0.9	0.5	0	0.7	0	0	1.4	0	0.5	2.7	1.2	0	0	1.7	1.0	0	0.4	0	0.6	1.0
MU Trucks	0	2	0	0	2	0	1	1	0	2	0	1	0	0	1	1	0	0	0	1	6
% MU Trucks	0	0.4	0	0	0.3	0	6.7	1.4	0	1.0	0	0.2	0	0	0.1	0.5	0	0	0	0.2	0.3

Manual Turning Movement Count

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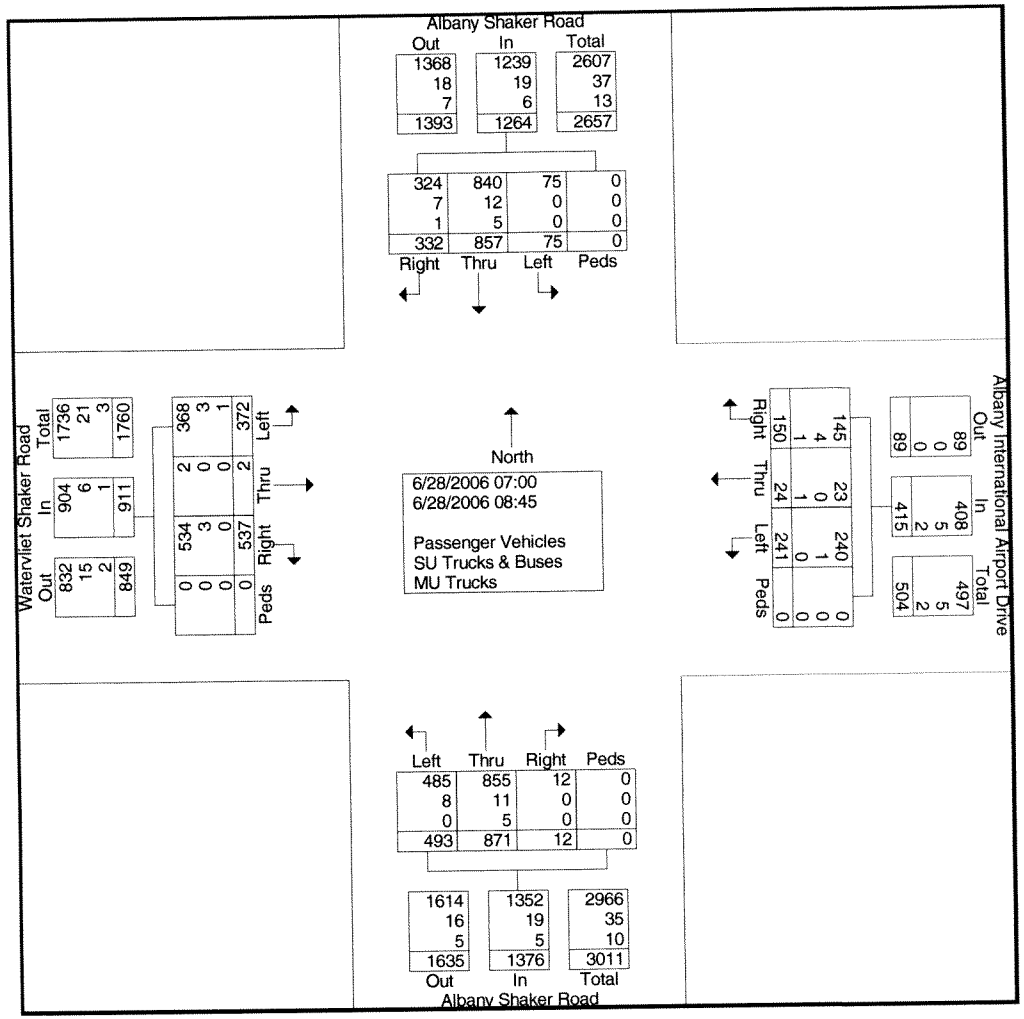
Exit 3 Airport Connector
Albany Shaker & Watervliet Shaker
AM
7 to 9

File Name : Albany Shaker - Watervliet Shaker AM
Site Code : 62806001
Start Date : 6/28/2006
Page No : 2



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Exit 3 Airport Connector
Albany Shaker & Watervliet Shaker
AM
7 to 9

File Name : Albany Shaker - Watervliet Shaker AM
Site Code : 62806001
Start Date : 6/28/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Albany Shaker Road Southbound					Albany International Airport Drive Westbound					Albany Shaker Road Northbound					Watervliet Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00	9	84	18	0	111	36	1	21	0	58	48	71	2	0	121	29	0	60	0	89	379
07:15	12	99	34	0	145	38	2	28	0	68	54	91	0	0	145	44	0	66	0	110	468
07:30	10	101	30	0	141	31	2	10	0	43	71	91	0	0	162	44	0	81	0	125	471
07:45	8	123	52	0	183	23	6	10	0	39	66	141	2	0	209	52	0	75	0	127	558
Total	39	407	134	0	580	128	11	69	0	208	239	394	4	0	637	169	0	282	0	451	1876
08:00	6	110	48	0	164	35	3	25	0	63	69	146	1	0	216	46	0	68	0	114	557
08:15	6	117	43	0	166	21	1	22	0	44	69	111	3	0	183	52	1	67	0	120	513
08:30	13	118	62	0	193	31	5	17	0	53	53	109	3	0	165	46	0	71	0	117	528
08:45	11	105	45	0	161	26	4	17	0	47	63	111	1	0	175	59	1	49	0	109	492
Total	36	450	198	0	684	113	13	81	0	207	254	477	8	0	739	203	2	255	0	460	2090
Grand Total	75	857	332	0	1264	241	24	150	0	415	493	871	12	0	1376	372	2	537	0	911	3966
Apprch %	5.9	67.8	26.3	0		58.1	5.8	36.1	0		35.8	63.3	0.9	0		40.8	0.2	58.9	0		
Total %	1.9	21.6	8.4	0	31.9	6.1	0.6	3.8	0	10.5	12.4	22	0.3	0	34.7	9.4	0.1	13.5	0	23	
Passenger Vehicles																					
% Passenger Vehicles	100	98	97.6	0	98	99.6	95.8	96.7	0	98.3	98.4	98.2	100	0	98.3	98.9	100	99.4	0	99.2	98.4
SU Trucks & Buses	0	12	7	0	19	1	0	4	0	5	8	11	0	0	19	3	0	3	0	6	49
% SU Trucks & Buses	0	1.4	2.1	0	1.5	0.4	0	2.7	0	1.2	1.6	1.3	0	0	1.4	0.8	0	0.6	0	0.7	1.2
MU Trucks	0	5	1	0	6	0	1	1	0	2	0	5	0	0	5	1	0	0	0	1	14
% MU Trucks	0	0.6	0.3	0	0.5	0	4.2	0.7	0	0.5	0	0.6	0	0	0.4	0.3	0	0	0	0.1	0.4

Manual Turning Movement Count

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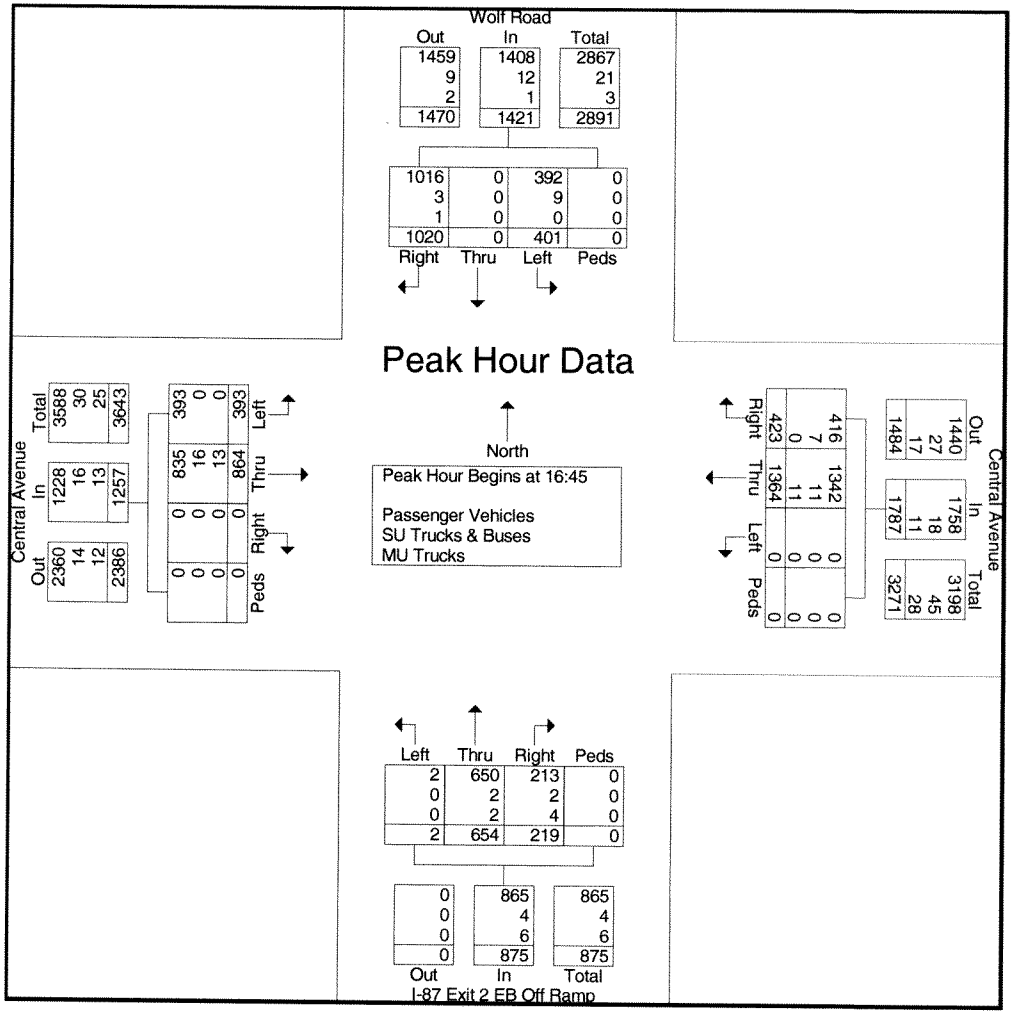
Exit 3 Ariport Connector
Wolf Rd & Central Ave
PM
4 to 6

File Name : Wolf - Central PM
Site Code : 62906010
Start Date : 6/29/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Ariport Connector
Wolf Rd & Central Ave
PM
4 to 6

File Name : Wolf - Central PM
Site Code : 62906010
Start Date : 6/29/2006
Page No : 3

	Wolf Road Southbound					Central Avenue Westbound					I-87 Exit 2 EB Off Ramp Northbound					Central Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:45																					
16:45	108	0	247	0	355	0	342	107	0	449	0	163	**59**			**104**	**223**			**327**	
17:00	92	0	263	0	355	0	**354**	91	0	445	**2**	160	54	0	216	96	212	0	0	308	1324
17:15	**114**	0	**300**	0	**414**	0	332	108	0	440	0	160	53	0	213	91	219	0	0	310	**1377**
17:30	87	0	210	0	297	0	336	**117**	0	**453**	0	**171**	53	0	**224**	102	210	0	0	312	1286
Total Volume	401	0	1020	0	1421	0	1364	423	0	1787	2	654	219	0	875	393	864	0	0	1257	5340
% App. Total	28.2	0	71.8	0		0	76.3	23.7	0		0.2	74.7	25	0		31.3	68.7	0	0		
PHF	.879	.000	.850	.000	.858	.000	.963	.904	.000	.986	.250	.956	.928	.000	.977	.945	.969	.000	.000	.961	.969
Passenger Vehicles	392	0	1016	0	1408	0	1342	416	0	1758	2	650	213	0	865	393	835	0	0	1228	5259
% Passenger Vehicles	97.8	0	99.6	0	99.1	0	98.4	98.3	0	98.4	100	99.4	97.3	0	98.9	100	96.6	0	0	97.7	98.5
SU Trucks & Buses	9	0	3	0	12	0	11	7	0	18	0	2	2	0	4	0	16	0	0	16	50
% SU Trucks & Buses	2.2	0	0.3	0	0.8	0	0.8	1.7	0	1.0	0	0.3	0.9	0	0.5	0	1.9	0	0	1.3	0.9
MU Trucks	0	0	1	0	1	0	11	0	0	11	0	2	4	0	6	0	13	0	0	13	31
% MU Trucks	0	0	0.1	0	0.1	0	0.8	0	0	0.6	0	0.3	1.8	0	0.7	0	1.5	0	0	1.0	0.6

Manual Turning Movement Count

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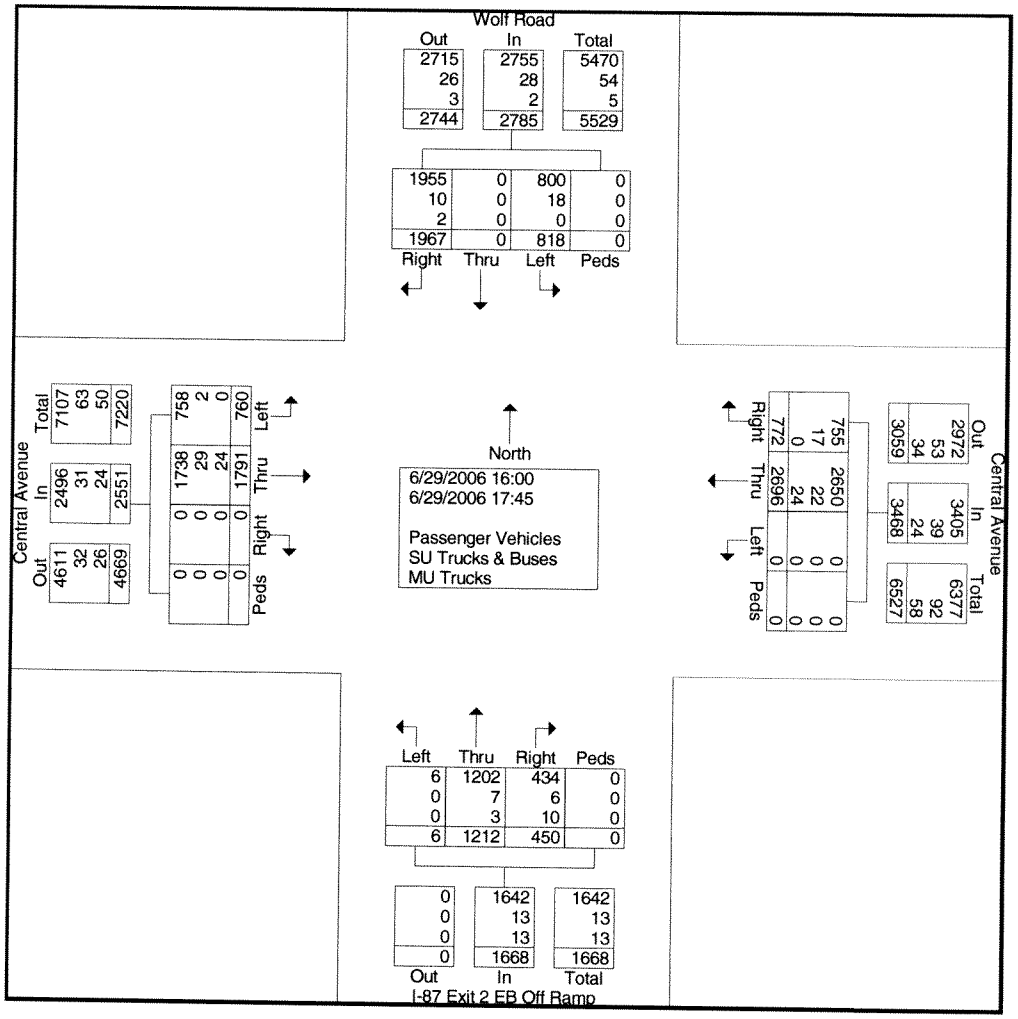
Exit 3 Ariport Connector
Wolf Rd & Central Ave
PM
4 to 6

File Name : Wolf - Central PM
Site Code : 62906010
Start Date : 6/29/2006
Page No : 2



Manual Turning Movement Count

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Exit 3 Ariport Connector
Wolf Rd & Central Ave
PM
4 to 6

File Name : Wolf - Central PM
Site Code : 62906010
Start Date : 6/29/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Central Avenue Westbound					I-87 Exit 2 EB Off Ramp Northbound					Central Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
16:00	111	0	217	0	328	0	354	83	0	437	1	130	49	0	180	90	218	0	0	308	1253
16:15	117	0	280	0	397	0	349	81	0	430	1	127	56	0	184	90	270	0	0	360	1371
16:30	95	0	240	0	335	0	339	91	0	430	2	150	53	0	205	88	225	0	0	313	1283
16:45	108	0	247	0	355	0	342	107	0	449	0	163	59	0	222	104	223	0	0	327	1353
Total	431	0	984	0	1415	0	1384	362	0	1746	4	570	217	0	791	372	936	0	0	1308	5260
17:00	92	0	263	0	355	0	354	91	0	445	2	160	54	0	216	96	212	0	0	308	1324
17:15	114	0	300	0	414	0	332	108	0	440	0	160	53	0	213	91	219	0	0	310	1377
17:30	87	0	210	0	297	0	336	117	0	453	0	171	53	0	224	102	210	0	0	312	1286
17:45	94	0	210	0	304	0	290	94	0	384	0	151	73	0	224	99	214	0	0	313	1225
Total	387	0	983	0	1370	0	1312	410	0	1722	2	642	233	0	877	388	855	0	0	1243	5212
Grand Total	818	0	1967	0	2785	0	2696	772	0	3468	6	1212	450	0	1668	760	1791	0	0	2551	10472
Apprch %	29.4	0	70.6	0		0	77.7	22.3	0		0.4	72.7	27	0		29.8	70.2	0	0		
Total %	7.8	0	18.8	0	26.6	0	25.7	7.4	0	33.1	0.1	11.6	4.3	0	15.9	7.3	17.1	0	0	24.4	
Passenger Vehicles																					
% Passenger Vehicles	97.8	0	99.4	0	98.9	0	98.3	97.8	0	98.2	100	99.2	96.4	0	98.4	99.7	97	0	0	97.8	98.3
SU Trucks & Buses	18	0	10	0	28	0	22	17	0	39	0	7	6	0	13	2	29	0	0	31	111
% SU Trucks & Buses	2.2	0	0.5	0	1	0	0.8	2.2	0	1.1	0	0.6	1.3	0	0.8	0.3	1.6	0	0	1.2	1.1
MU Trucks	0	0	2	0	2	0	24	0	0	24	0	3	10	0	13	0	24	0	0	24	63
% MU Trucks	0	0	0.1	0	0.1	0	0.9	0	0	0.7	0	0.2	2.2	0	0.8	0	1.3	0	0	0.9	0.6

Manual Turning Movement Count

Clough, Harbour & Associates LLP

III Winners Circle, P.O. Box 5269

Albany, NY 12205

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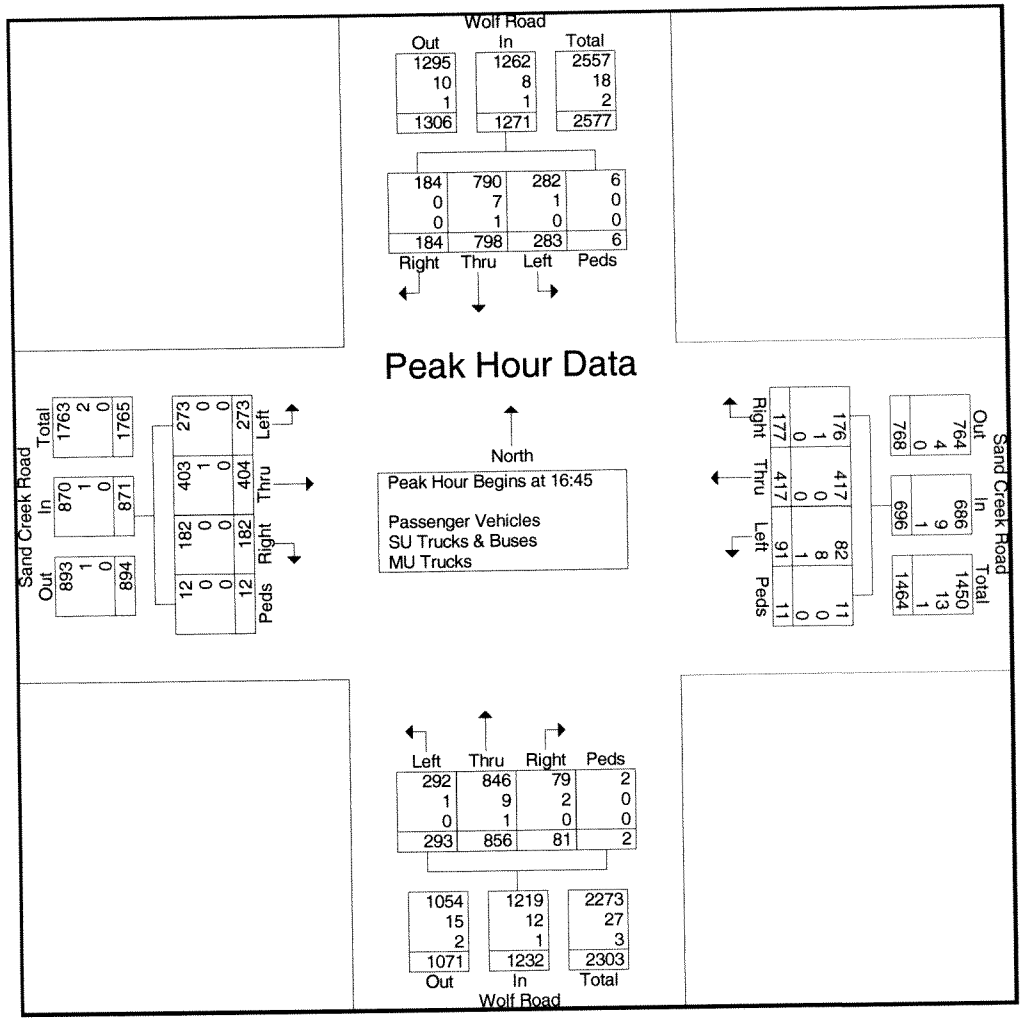
Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
PM
4 to 6

File Name : Wolf - Sand Creek PM
Site Code : 62806006
Start Date : 6/28/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
PM
4 to 6

File Name : Wolf - Sand Creek PM
Site Code : 62806006
Start Date : 6/28/2006
Page No : 3

	Wolf Road Southbound					Sand Creek Road Westbound					Wolf Road Northbound					Sand Creek Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:45																					
16:45	68	195	44	0	307	22	92	45	1	160	68	194	22	**2**							
17:00	67	209	48	**4**	328	25	93	44	**5**	167	73	201	17	0	291	**73**	93	41	**4**	211	997
17:15	**77**	**212**	**58**	2	**349**	18	102	34	3	157	**77**	**251**	**26**	0	**354**	61	92	**61**	4	218	**1078**
17:30	71	182	34	0	287	**26**	**130**	**54**	2	**212**	75	210	16	0	301	67	**134**	33	3	**237**	1037
Total Volume	283	798	184	6	1271	91	417	177	11	696	293	856	81	2	1232	273	404	182	12	871	4070
% App. Total	22.3	62.8	14.5	0.5		13.1	59.9	25.4	1.6		23.8	69.5	6.6	0.2		31.3	46.4	20.9	1.4		
PHF	.919	.941	.793	.375	.910	.875	.802	.819	.550	.821	.951	.853	.779	.250	.870	.935	.754	.746	.750	.919	.944
Passenger Vehicles	282	790	184	6	1262	82	417	176	11	686	292	846	79	2	1219	273	403	182	12	870	4037
% Passenger Vehicles	99.6	99.0	100	100	99.3	90.1	100	99.4	100	98.6	99.7	98.8	97.5	100	98.9	100	99.8	100	100	99.9	99.2
SU Trucks & Buses	1	7	0	0	8	8	0	1	0	9	1	9	2	0	12	0	1	0	0	1	30
% SU Trucks & Buses	0.4	0.9	0	0	0.6	8.8	0	0.6	0	1.3	0.3	1.1	2.5	0	1.0	0	0.2	0	0	0.1	0.7
MU Trucks	0	1	0	0	1	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	3
% MU Trucks	0	0.1	0	0	0.1	1.1	0	0	0	0.1	0	0.1	0	0	0.1	0	0	0	0	0	0.1

Manual Turning Movement Count

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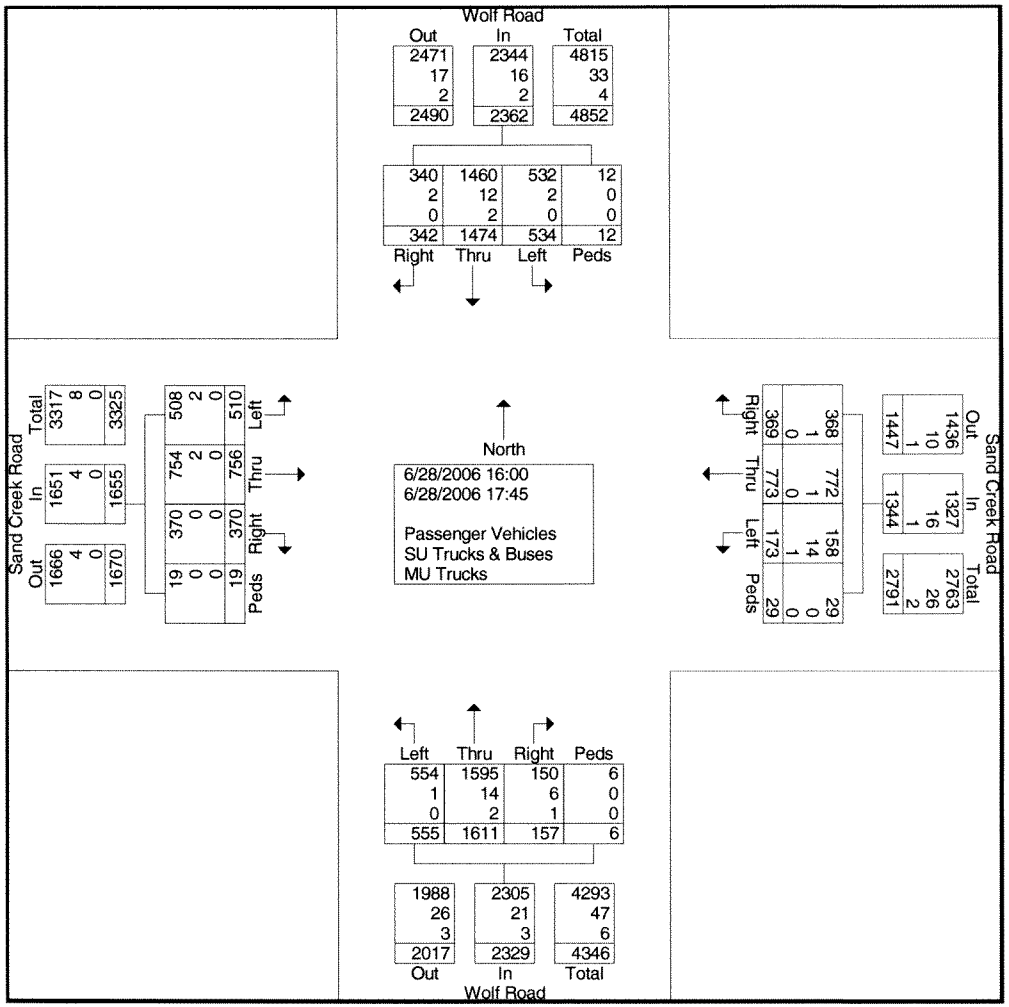
Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
PM
4 to 6

File Name : Wolf - Sand Creek PM
Site Code : 62806006
Start Date : 6/28/2006
Page No : 2



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Sand Creek Rd
PM
4 to 6

File Name : Wolf - Sand Creek PM
Site Code : 62806006
Start Date : 6/28/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Sand Creek Road Westbound					Wolf Road Northbound					Sand Creek Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
16:00	61	195	39	1	296	29	65	40	7	141	60	227	16	1	304	60	77	31	2	170	911
16:15	56	152	43	1	252	21	83	50	3	157	66	177	19	1	263	68	81	48	2	199	871
16:30	67	170	40	3	280	16	89	44	5	154	71	179	21	0	271	51	79	54	1	185	890
16:45	68	195	44	0	307	22	92	45	1	160	68	194	22	2	286	72	85	47	1	205	958
Total	252	712	166	5	1135	88	329	179	16	612	265	777	78	4	1124	251	322	180	6	759	3630
17:00	67	209	48	4	328	25	93	44	5	167	73	201	17	0	291	73	93	41	4	211	997
17:15	77	212	58	2	349	18	102	34	3	157	77	251	26	0	354	61	92	61	4	218	1078
17:30	71	182	34	0	287	26	130	54	2	212	75	210	16	0	301	67	134	33	3	237	1037
17:45	67	159	36	1	263	16	119	58	3	196	65	172	20	2	259	58	115	55	2	230	948
Total	282	762	176	7	1227	85	444	190	13	732	290	834	79	2	1205	259	434	190	13	896	4060
Grand Total	534	1474	342	12	2362	173	773	369	29	1344	555	1611	157	6	2329	510	756	370	19	1655	7690
Apprch %	22.6	62.4	14.5	0.5		12.9	57.5	27.5	2.2		23.8	69.2	6.7	0.3		30.8	45.7	22.4	1.1		
Total %	6.9	19.2	4.4	0.2	30.7	2.2	10.1	4.8	0.4	17.5	7.2	20.9	2	0.1	30.3	6.6	9.8	4.8	0.2	21.5	
Passenger Vehicles																					
% Passenger Vehicles	99.6	99.1	99.4	100	99.2	91.3	99.9	99.7	100	98.7	99.8	99	95.5	100	99	99.6	99.7	100	100	99.8	99.2
SU Trucks & Buses	2	12	2	0	16	14	1	1	0	16	1	14	6	0	21	2	2	0	0	4	57
% SU Trucks & Buses	0.4	0.8	0.6	0	0.7	8.1	0.1	0.3	0	1.2	0.2	0.9	3.8	0	0.9	0.4	0.3	0	0	0.2	0.7
MU Trucks	0	2	0	0	2	1	0	0	0	1	0	2	1	0	3	0	0	0	0	0	6
% MU Trucks	0	0.1	0	0	0.1	0.6	0	0	0	0.1	0	0.1	0.6	0	0.1	0	0	0	0	0	0.1

Manual Turning Movement Count

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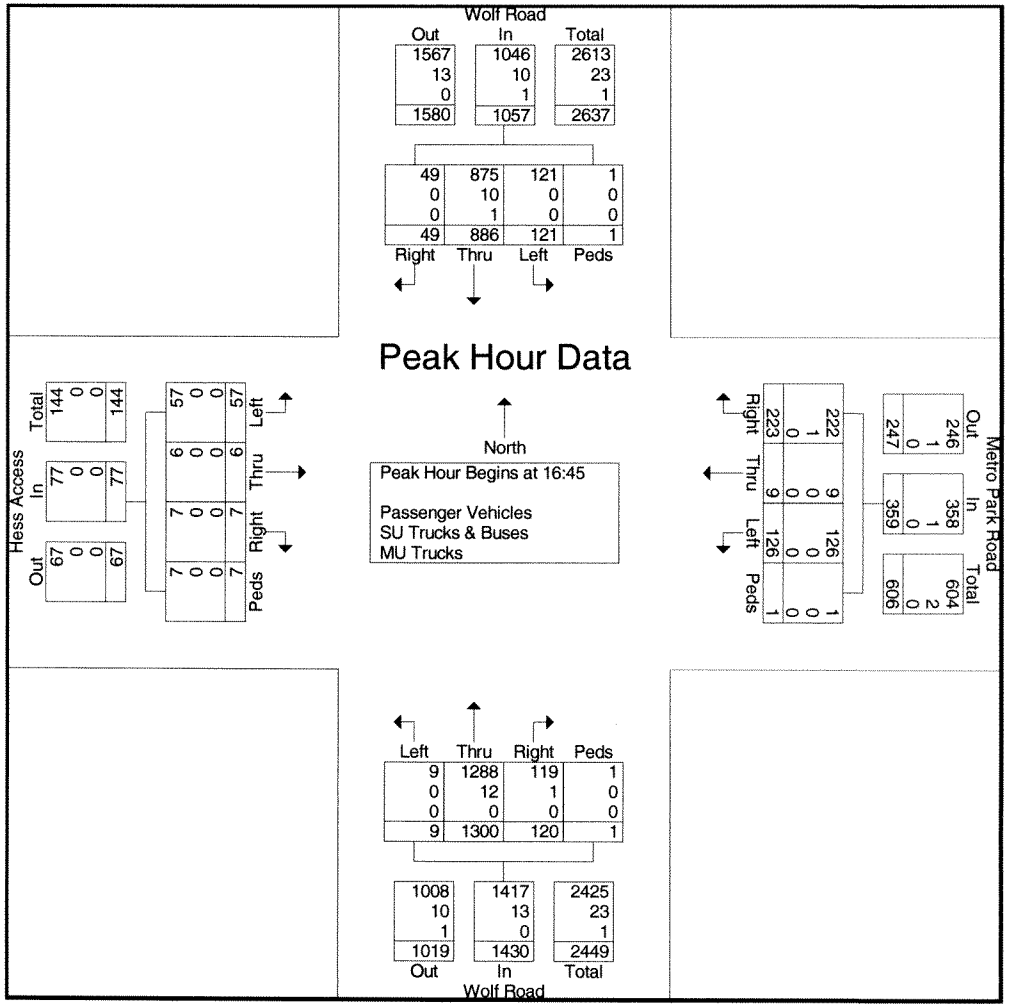
Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
PM
4 to 6

File Name : Wolf - Metro Park PM
Site Code : 62806004
Start Date : 6/28/2006
Page No : 4



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Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
PM
4 to 6

File Name : Wolf - Metro Park PM
Site Code : 62806004
Start Date : 6/28/2006
Page No : 3

	Wolf Road Southbound					Metro Park Road Westbound					Wolf Road Northbound					Hess Access Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:45																					
16:45	25	220	13	0	258	34	1	59	**1**												
17:00	31	223	10	0	264	**35**	1	**69**	0	**105**	**4**	**372**	32	**1**	**409**	11	2	2	0	15	**793**
17:15	25	212	**14**	**1**	252	35	**4**	51	0	90	2	325	**34**	0	361	**17**	**3**	0	**5**	**25**	728
17:30	**40**	**231**	12	0	**283**	22	3	44	0	69	1	305	31	0	337	16	0	**3**	1	20	709
Total Volume	121	886	49	1	1057	126	9	223	1	359	9	1300	120	1	1430	57	6	7	7	77	2923
% App. Total	11.4	83.8	4.6	0.1		35.1	2.5	62.1	0.3		0.6	90.9	8.4	0.1		74	7.8	9.1	9.1		
PHF	.756	.959	.875	.250	.934	.900	.563	.808	.250	.855	.563	.874	.882	.250	.874	.838	.500	.583	.350	.770	.922
Passenger Vehicles	121	875	49	1	1046	126	9	222	1	358	9	1288	119	1	1417	57	6	7	7	77	2898
% Passenger Vehicles	100	98.8	100	100	99.0	100	100	99.6	100	99.7	100	99.1	99.2	100	99.1	100	100	100	100	100	99.1
SU Trucks & Buses	0	10	0	0	10	0	0	1	0	1	0	12	1	0	13	0	0	0	0	0	24
% SU Trucks & Buses	0	1.1	0	0	0.9	0	0	0.4	0	0.3	0	0.9	0.8	0	0.9	0	0	0	0	0	0.8
MU Trucks	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% MU Trucks	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

Manual Turning Movement Count

Clough, Harbour & Associates LLP

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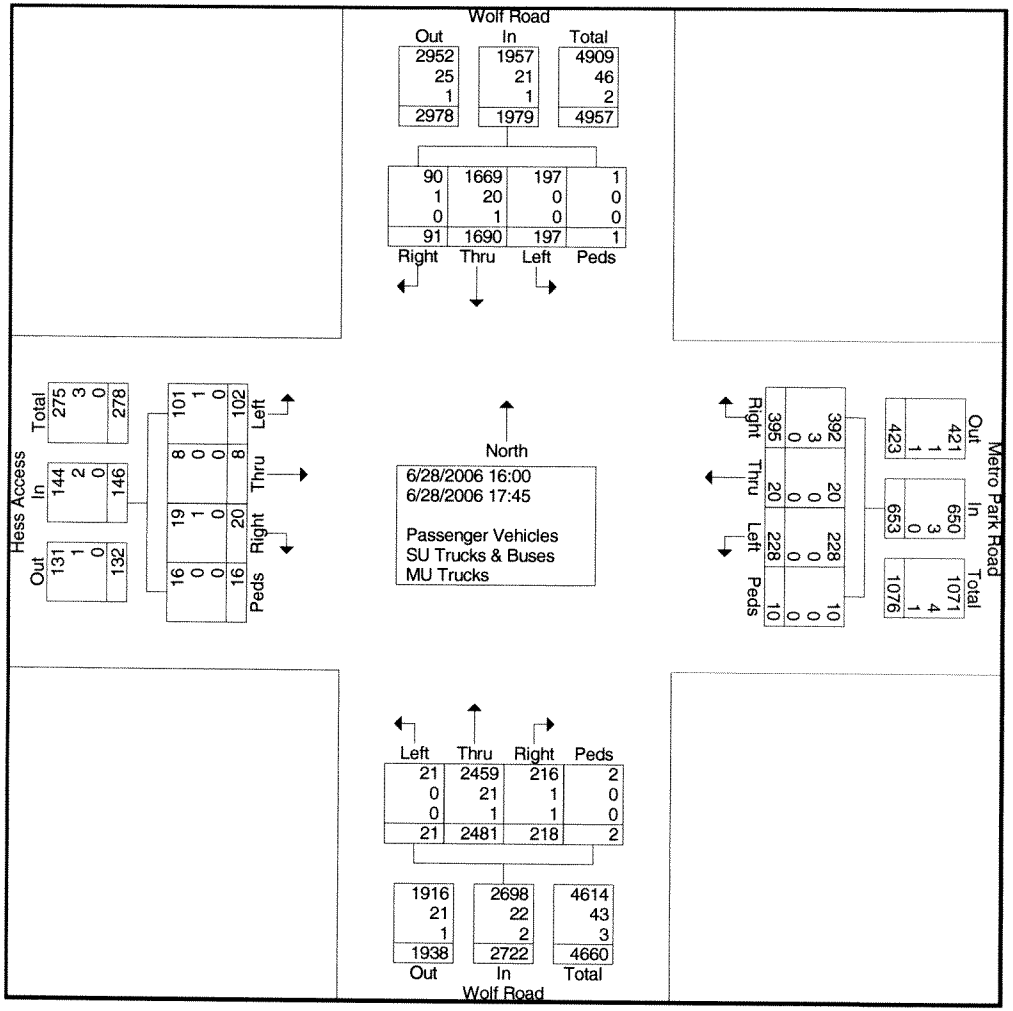
Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
PM
4 to 6

File Name : Wolf - Metro Park PM
Site Code : 62806004
Start Date : 6/28/2006



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Metro Park Rd
PM
4 to 6

File Name : Wolf - Metro Park PM
Site Code : 62806004
Start Date : 6/28/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Metro Park Road Westbound					Wolf Road Northbound					Hess Access Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
16:00	15	193	10	0	218	35	6	47	2	90	5	277	19	0	301	9	1	4	2	16	625
16:15	13	218	9	0	240	13	2	31	0	46	2	305	21	1	329	16	0	4	2	22	637
16:30	21	197	10	0	228	37	2	52	2	93	2	320	24	0	346	10	1	3	2	16	683
16:45	25	220	13	0	258	34	1	59	1	95	2	298	23	0	323	13	1	2	1	17	693
Total	74	828	42	0	944	119	11	189	5	324	11	1200	87	1	1299	48	3	13	7	71	2638
17:00	31	223	10	0	264	35	1	69	0	105	4	372	32	1	409	11	2	2	0	15	793
17:15	25	212	14	1	252	35	4	51	0	90	2	325	34	0	361	17	3	0	5	25	728
17:30	40	231	12	0	283	22	3	44	0	69	1	305	31	0	337	16	0	3	1	20	709
17:45	27	196	13	0	236	17	1	42	5	65	3	279	34	0	316	10	0	2	3	15	632
Total	123	862	49	1	1035	109	9	206	5	329	10	1281	131	1	1423	54	5	7	9	75	2862
Grand Total	197	1690	91	1	1979	228	20	395	10	653	21	2481	218	2	2722	102	8	20	16	146	5500
Apprch %	10	85.4	4.6	0.1		34.9	3.1	60.5	1.5		0.8	91.1	8	0.1		69.9	5.5	13.7	11		
Total %	3.6	30.7	1.7	0	36	4.1	0.4	7.2	0.2	11.9	0.4	45.1	4	0	49.5	1.9	0.1	0.4	0.3	2.7	
Passenger Vehicles																					
% Passenger Vehicles	100	98.8	98.9	100	98.9	100	100	99.2	100	99.5	100	99.1	99.1	100	99.1	99	100	95	100	98.6	99.1
SU Trucks & Buses	0	20	1	0	21	0	0	3	0	3	0	21	1	0	22	1	0	1	0	2	48
% SU Trucks & Buses	0	1.2	1.1	0	1.1	0	0	0.8	0	0.5	0	0.8	0.5	0	0.8	1	0	5	0	1.4	0.9
MU Trucks	0	1	0	0	1	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	3
% MU Trucks	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0.5	0	0.1	0	0	0	0	0	0.1

Manual Turning Movement Count

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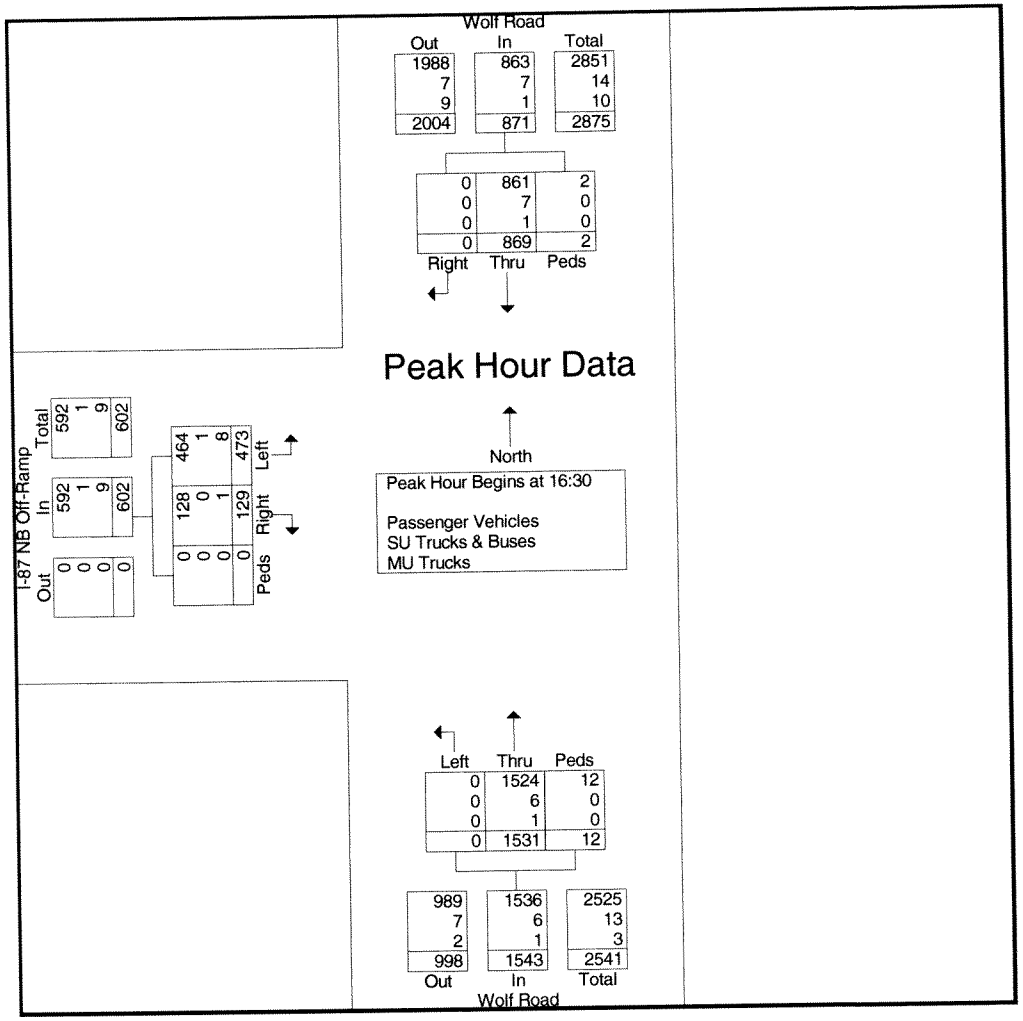
Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
PM
4 to 6

File Name : Wolf - Exit 4 NB Off-Ramp PM
Site Code : 71106002
Start Date : 7/11/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
PM
4 to 6

File Name : Wolf - Exit 4 NB Off-Ramp PM
Site Code : 71106002
Start Date : 7/11/2006

	Wolf Road Southbound					Wolf Road Northbound					I-87 NB Off-Ramp Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:30																					
16:30	0	191	0	**1**																	
16:45	0	**260**	0	0	**260**	0	0	0	0	0	0	371	0	**8**	379	106	0	**41**	0	147	786
17:00	0	200	0	0	200	0	0	0	0	0	0	**449**	**1**	2	**452**	109	0	33	0	142	**794**
17:15	0	218	0	1	219	0	0	0	0	0	0	365	0	1	366	**140**	0	26	0	**166**	751
Total Volume	0	869	0	2	871	0	0	0	0	0	0	1531	1	12	1544	473	0	129	0	602	3017
% App. Total	0	99.8	0	0.2		0	0	0	0		0	99.2	0.1	0.8		78.6	0	21.4	0		
PHF	.000	.836	.000	.500	.838	.000	.000	.000	.000	.000	.000	.852	.250	.375	.854	.845	.000	.787	.000	.907	.950
Passenger Vehicles	0	861	0	2	863	0	0	0	0	0	0	1524	1	12	1537	464	0	128	0	592	2992
% Passenger Vehicles	0	99.1	0	100	99.1	0	0	0	0	0	0	99.5	100	100	99.5	98.1	0	99.2	0	98.3	99.2
SU Trucks & Buses	0	7	0	0	7	0	0	0	0	0	0	6	0	0	6	1	0	0	0	1	14
% SU Trucks & Buses	0	0.8	0	0	0.8	0	0	0	0	0	0	0.4	0	0	0.4	0.2	0	0	0	0.2	0.5
MU Trucks	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	8	0	1	0	9	11
% MU Trucks	0	0.1	0	0	0.1	0	0	0	0	0	0	0.1	0	0	0.1	1.7	0	0.8	0	1.5	0.4

Manual Turning Movement Count

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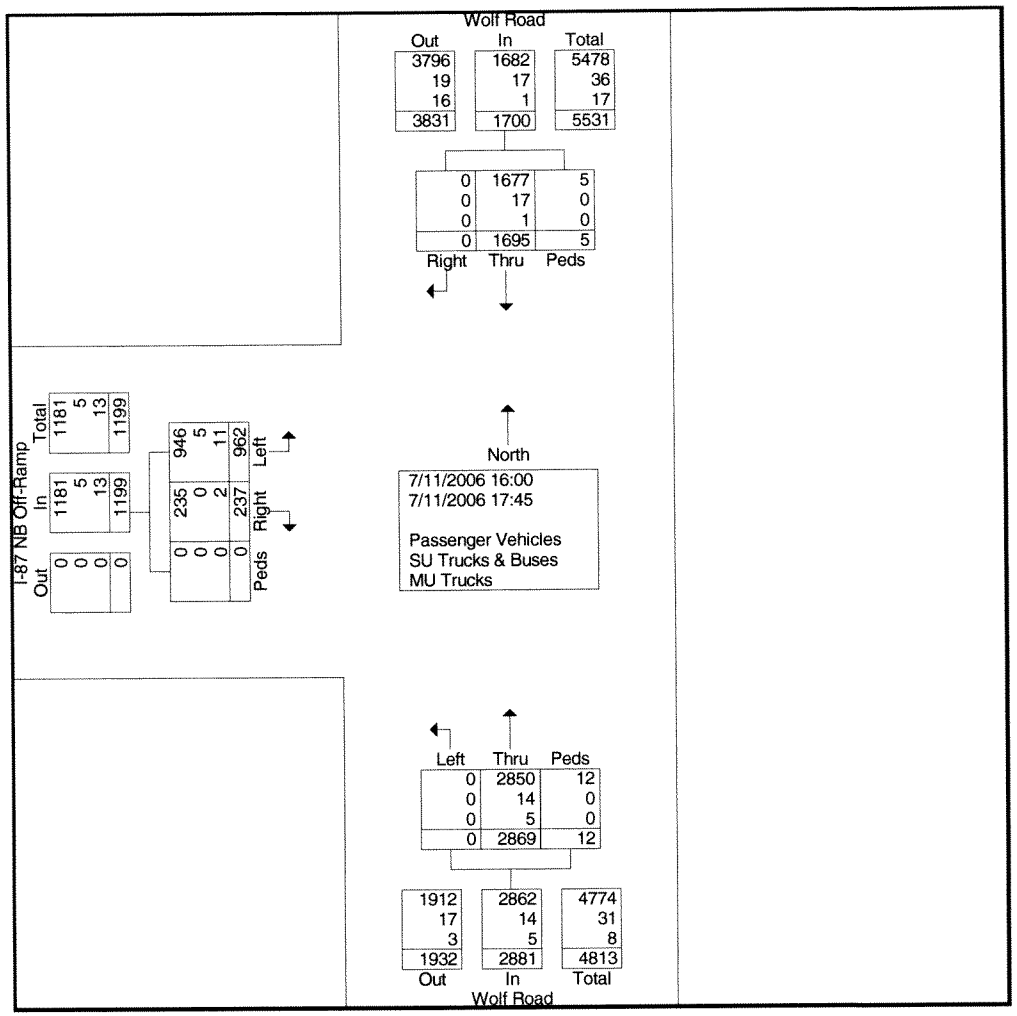
Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
PM
4 to 6

File Name : Wolf - Exit 4 NB Off-Ramp PM
Site Code : 71106002
Start Date : 7/11/2006
Page No : 2



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Exit 3 Airport Connector
Wolf & I-87 NB Off-Ramp
PM
4 to 6

File Name : Wolf - Exit 4 NB Off-Ramp PM
Site Code : 71106002
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Wolf Road Southbound					Wolf Road Northbound					I-87 NB Off-Ramp Eastbound									
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
16:00	0	207	0	0	207	0	0	0	0	0	0	368	0	0	368	136	0	22	0	158	733
16:15	0	199	0	1	200	0	0	0	0	0	0	344	0	0	344	137	0	18	0	155	699
16:30	0	191	0	1	192	0	0	0	0	0	0	346	0	1	347	118	0	29	0	147	686
16:45	0	260	0	0	260	0	0	0	0	0	0	371	0	8	379	106	0	41	0	147	786
Total	0	857	0	2	859	0	0	0	0	0	0	1429	0	9	1438	497	0	110	0	607	2904
17:00	0	200	0	0	200	0	0	0	0	0	0	449	1	2	452	109	0	33	0	142	794
17:15	0	218	0	1	219	0	0	0	0	0	0	365	0	1	366	140	0	26	0	166	751
17:30	0	208	0	0	208	0	0	0	0	0	0	308	0	0	308	107	0	36	0	143	659
17:45	0	212	0	2	214	0	0	0	0	0	0	318	0	0	318	109	0	32	0	141	673
Total	0	838	0	3	841	0	0	0	0	0	0	1440	1	3	1444	465	0	127	0	592	2877
Grand Total	0	1695	0	5	1700	0	0	0	0	0	0	2869	1	12	2882	962	0	237	0	1199	5781
Apprch %	0	99.7	0	0.3		0	0	0	0		0	99.5	0	0.4		80.2	0	19.8	0		
Total %	0	29.3	0	0.1	29.4	0	0	0	0	0	0	49.6	0	0.2	49.9	16.6	0	4.1	0	20.7	
Passenger Vehicles																					
% Passenger Vehicles	0	98.9	0	100	98.9	0	0	0	0	0	0	99.3	100	100	99.3	98.3	0	99.2	0	98.5	99
SU Trucks & Buses	0	17	0	0	17	0	0	0	0	0	0	14	0	0	14	5	0	0	0	5	36
% SU Trucks & Buses	0	1	0	0	1	0	0	0	0	0	0	0.5	0	0	0.5	0.5	0	0	0	0.4	0.6
MU Trucks	0	1	0	0	1	0	0	0	0	0	0	5	0	0	5	11	0	2	0	13	19
% MU Trucks	0	0.1	0	0	0.1	0	0	0	0	0	0	0.2	0	0	0.2	1.1	0	0.8	0	1.1	0.3

Manual Turning Movement Count

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III Winners Circle, P.O. Box 5269

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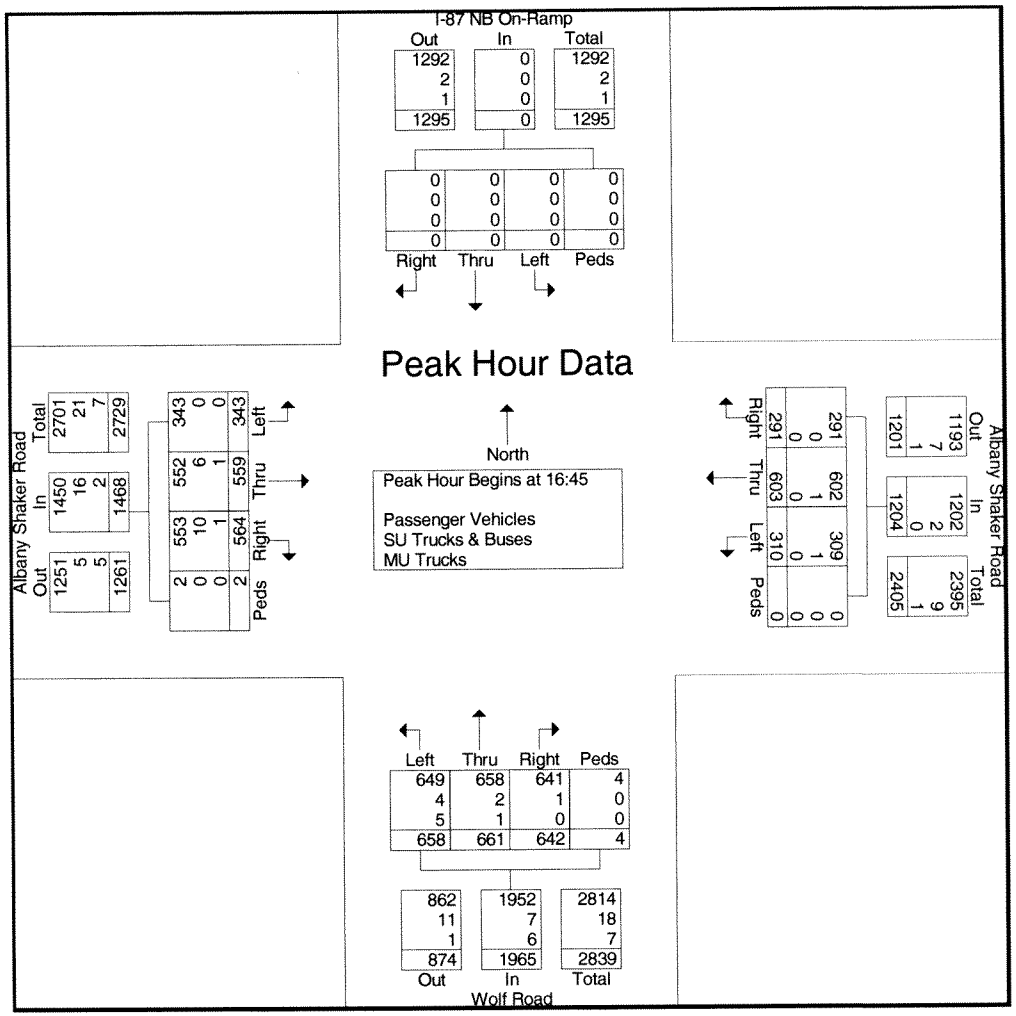
Exit 3 Airport Connector
Wolf Rd & Albany Shaker
PM
4 to 6

File Name : Albany Shaker - Wolf PM
Site Code : 71106006
Start Date : 7/11/2006
Page No : 4



Manual Turning Movement Count

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Exit 3 Airport Connector
Wolf Rd & Albany Shaker
PM
4 to 6

File Name : Albany Shaker - Wolf PM
Site Code : 71106006
Start Date : 7/11/2006
Page No : 3

	I-87 NB On-Ramp Southbound					Albany Shaker Road Westbound					Wolf Road Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:45																					
												203					**169**	**155**		**416**	**1233**
16:45	0	0	0	0	0	83	144	77	0	304	170	188	**183**	0	**547**	72	143	124	0	339	1158
17:00	0	0	0	0	0	63	146	63	0	272	**176**	136	175	0	456	**95**	114	155	**2**	366	1124
17:15	0	0	0	0	0	80	138	**84**	0	302	145	134	144	**4**	449	84	133	130	0	347	1122
17:30	0	0	0	0	0	**84**	**175**	67	0	**326**	167	661	642	4	1965	343	559	564	2	1468	4637
Total Volume	0	0	0	0	0	310	603	291	0	1204	658	33.6	32.7	0.2		23.4	38.1	38.4	0.1		
% App. Total	0	0	0	0		25.7	50.1	24.2	0		33.5	.814	.877	.250	.898	.903	.827	.910	.250	.882	.940
PHF	.000	.000	.000	.000	.000	.923	.861	.866	.000	.923	.935	658	641	4	1952	343	552	553	2	1450	4604
Passenger Vehicles	0	0	0	0	0	309	602	291	0	1202	649	99.5	99.8	100	99.3	100	98.7	98.0	100	98.8	99.3
% Passenger Vehicles	0	0	0	0	0	99.7	99.8	100	0	99.8	98.6	2	1	0	7	0	6	10	0	16	25
SU Trucks & Buses	0	0	0	0	0	1	1	0	0	2	4	0.3	0.2	0	0.4	0	1.1	1.8	0	1.1	0.5
% SU Trucks & Buses	0	0	0	0	0	0.3	0.2	0	0	0.2	0.6	1	0	0	6	0	1	1	0	2	8
MU Trucks	0	0	0	0	0	0	0	0	0	0	5	0.2	0	0	0.3	0	0.2	0.2	0	0.1	0.2
% MU Trucks	0	0	0	0	0	0	0	0	0	0	0.8										

Manual Turning Movement Count

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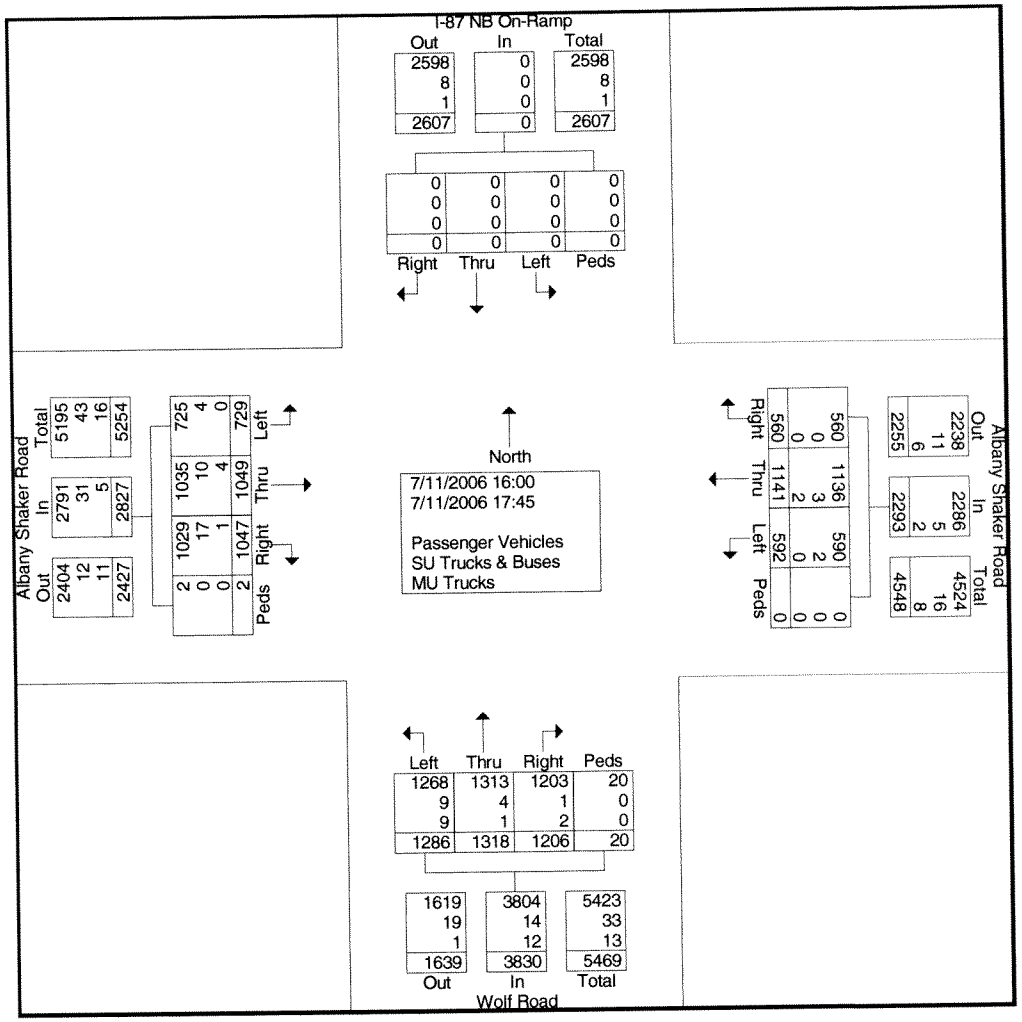
Exit 3 Airport Connector
Wolf Rd & Albany Shaker
PM
4 to 6

File Name : Albany Shaker - Wolf PM
Site Code : 71106006
Start Date : 7/11/2006
Page No : 2



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Exit 3 Airport Connector
Wolf Rd & Albany Shaker
PM
4 to 6

File Name : Albany Shaker - Wolf PM
Site Code : 71106006
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	I-87 NB On-Ramp Southbound					Albany Shaker Road Westbound					Wolf Road Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
16:00	0	0	0	0	0	60	122	69	0	251	158	160	146	0	464	99	125	128	0	352	1067
16:15	0	0	0	0	0	71	157	69	0	297	180	157	131	16	484	116	121	114	0	351	1132
16:30	0	0	0	0	0	79	151	71	0	301	149	167	131	0	447	95	127	120	0	342	1090
16:45	0	0	0	0	0	83	144	77	0	304	170	203	140	0	513	92	169	155	0	416	1233
Total	0	0	0	0	0	293	574	286	0	1153	657	687	548	16	1908	402	542	517	0	1461	4522
17:00	0	0	0	0	0	63	146	63	0	272	176	188	183	0	547	72	143	124	0	339	1158
17:15	0	0	0	0	0	80	138	84	0	302	145	136	175	0	456	95	114	155	2	366	1124
17:30	0	0	0	0	0	84	175	67	0	326	167	134	144	4	449	84	133	130	0	347	1122
17:45	0	0	0	0	0	72	108	60	0	240	141	173	156	0	470	76	117	121	0	314	1024
Total	0	0	0	0	0	299	567	274	0	1140	629	631	658	4	1922	327	507	530	2	1366	4428
Grand Total	0	0	0	0	0	592	1141	560	0	2293	1286	1318	1206	20	3830	729	1049	1047	2	2827	8950
Apprch %	0	0	0	0		25.8	49.8	24.4	0		33.6	34.4	31.5	0.5		25.8	37.1	37	0.1		
Total %	0	0	0	0	0	6.6	12.7	6.3	0	25.6	14.4	14.7	13.5	0.2	42.8	8.1	11.7	11.7	0	31.6	
Passenger Vehicles																					
% Passenger Vehicles	0	0	0	0	0	99.7	99.6	100	0	99.7	98.6	99.6	99.8	100	99.3	99.5	98.7	98.3	100	98.7	99.2
SU Trucks & Buses	0	0	0	0	0	2	3	0	0	5	9	4	1	0	14	4	10	17	0	31	50
% SU Trucks & Buses	0	0	0	0	0	0.3	0.3	0	0	0.2	0.7	0.3	0.1	0	0.4	0.5	1	1.6	0	1.1	0.6
MU Trucks	0	0	0	0	0	0	2	0	0	2	9	1	2	0	12	0	4	1	0	5	19
% MU Trucks	0	0	0	0	0	0	0.2	0	0	0.1	0.7	0.1	0.2	0	0.3	0	0.4	0.1	0	0.2	0.2

Manual Turning Movement Count

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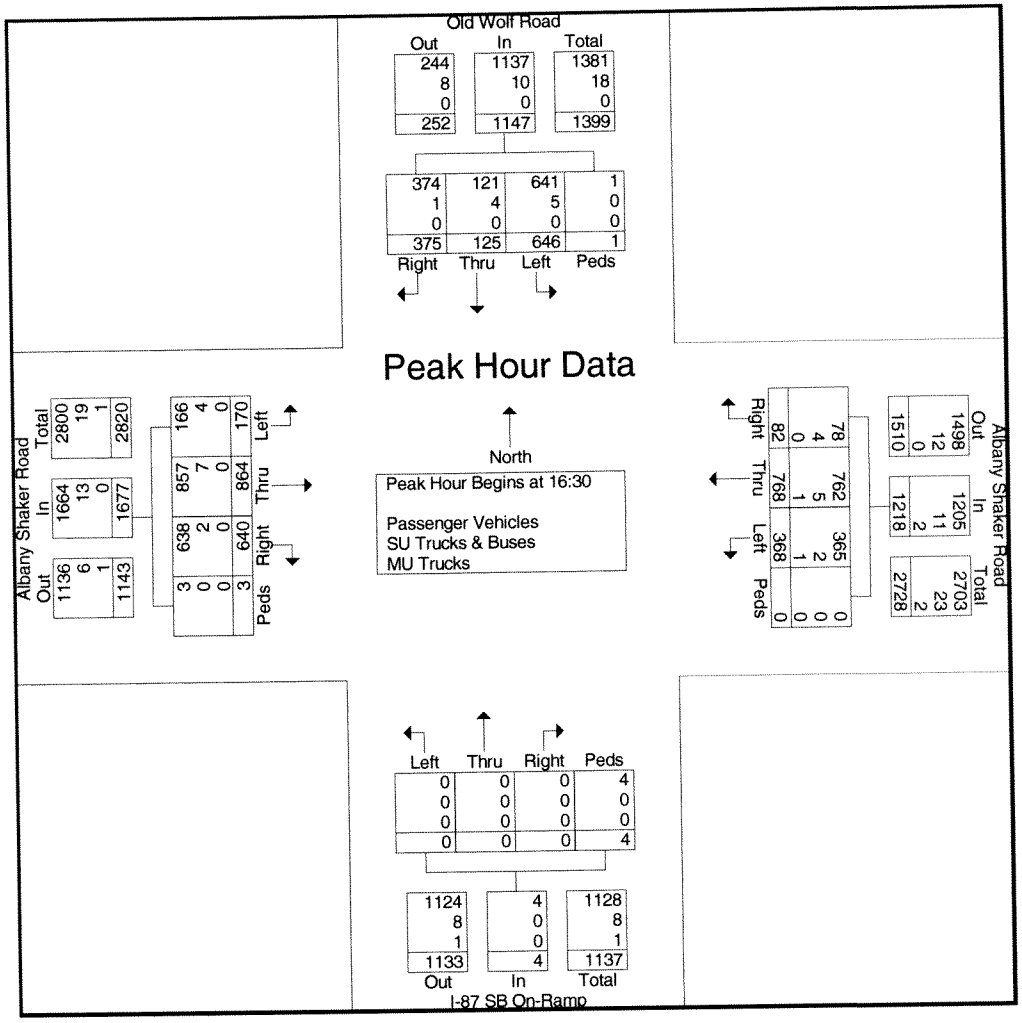
Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
PM
4 to 6

File Name : Albany Shaker - Old Wolf PM
Site Code : 71106004
Start Date : 7/11/2006
Page No : 4



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Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
PM
4 to 6

File Name : Albany Shaker - Old Wolf PM
Site Code : 71106004
Start Date : 7/11/2006
Page No : 3

	Old Wolf Road Southbound					Albany Shaker Road Westbound					I-87 SB On-Ramp Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:30																					
16:30	134	29	85	0	248	87	185	17	0	289	0	0	0	**3**	**3**						
16:45	**183**	18	85	**1**	287	87	**209**	**25**	0	**321**	0	0	0	1	1	48	219	160	**2**	429	1038
17:00	165	**51**	**113**	0	**329**	**100**	177	15	0	292	0	0	0	0	0	23	201	158	0	382	1003
17:15	164	27	92	0	283	94	197	25	0	316	0	0	0	0	0	**64**	**224**	**164**	0	**452**	**1051**
Total Volume	646	125	375	1	1147	368	768	82	0	1218	0	0	0	4	4	170	864	640	3	1677	4046
% App. Total	56.3	10.9	32.7	0.1		30.2	63.1	6.7	0		0	0	0	100		10.1	51.5	38.2	0.2		
PHF	.883	.613	.830	.250	.872	.920	.919	.820	.000	.949	.000	.000	.000	.333	.333	.664	.964	.976	.375	.928	.962
Passenger Vehicles	641	121	374	1	1137	365	762	78	0	1205	0	0	0	4	4	166	857	638	3	1664	4010
% Passenger Vehicles	99.2	96.8	99.7	100	99.1	99.2	99.2	95.1	0	98.9	0	0	0	100	100	97.6	99.2	99.7	100	99.2	99.1
SU Trucks & Buses	5	4	1	0	10	2	5	4	0	11	0	0	0	0	0	4	7	2	0	13	34
% SU Trucks & Buses	0.8	3.2	0.3	0	0.9	0.5	0.7	4.9	0	0.9	0	0	0	0	0	2.4	0.8	0.3	0	0.8	0.8
MU Trucks	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	2
% MU Trucks	0	0	0	0	0	0.3	0.1	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0.0

Manual Turning Movement Count

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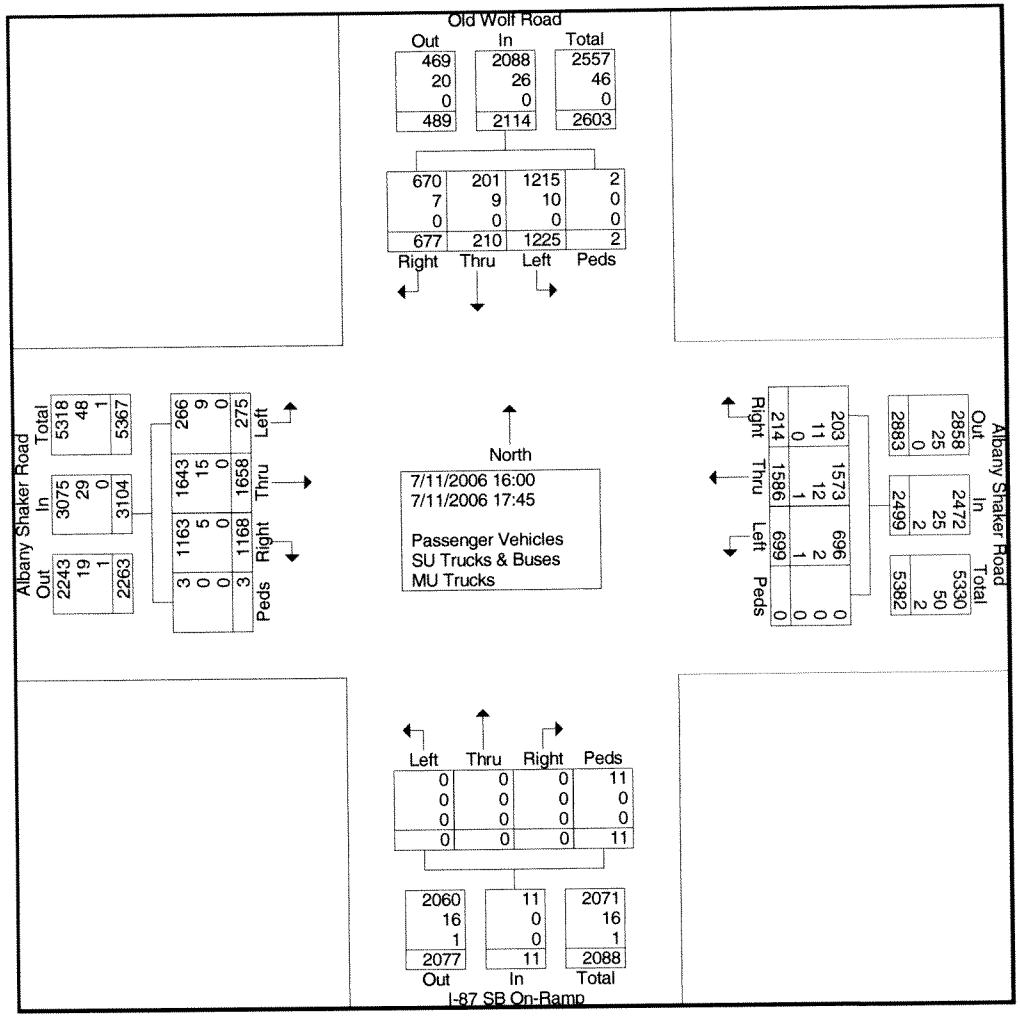
Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
PM
4 to 6

File Name : Albany Shaker - Old Wolf PM
Site Code : 71106004
Start Date : 7/11/2006
Page No : 2



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Exit 3 Airport Connector
Albany Shaker & Old Wolf Rd
PM
4 to 6

File Name : Albany Shaker - Old Wolf PM
Site Code : 71106004
Start Date : 7/11/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Old Wolf Road Southbound					Albany Shaker Road Westbound					I-87 SB On-Ramp Northbound					Albany Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
16:00	148	18	85	0	251	74	191	38	0	303	0	0	0	0	0	27	202	126	0	355	909
16:15	137	38	92	0	267	90	242	27	0	359	0	0	0	4	4	28	216	157	0	401	1031
16:30	134	29	85	0	248	87	185	17	0	289	0	0	0	3	3	35	220	158	1	414	954
16:45	183	18	85	1	287	87	209	25	0	321	0	0	0	1	1	48	219	160	2	429	1038
Total	602	103	347	1	1053	338	827	107	0	1272	0	0	0	8	8	138	857	601	3	1599	3932
17:00	165	51	113	0	329	100	177	15	0	292	0	0	0	0	0	23	201	158	0	382	1003
17:15	164	27	92	0	283	94	197	25	0	316	0	0	0	0	0	64	224	164	0	452	1051
17:30	155	14	70	0	239	88	212	40	0	340	0	0	0	1	1	23	202	119	0	344	924
17:45	139	15	55	1	210	79	173	27	0	279	0	0	0	2	2	27	174	126	0	327	818
Total	623	107	330	1	1061	361	759	107	0	1227	0	0	0	3	3	137	801	567	0	1505	3796
Grand Total	1225	210	677	2	2114	699	1586	214	0	2499	0	0	0	11	11	275	1658	1168	3	3104	7728
Apprch %	57.9	9.9	32	0.1		28	63.5	8.6	0		0	0	0	100		8.9	53.4	37.6	0.1		
Total %	15.9	2.7	8.8	0	27.4	9	20.5	2.8	0	32.3	0	0	0	0.1	0.1	3.6	21.5	15.1	0	40.2	
Passenger Vehicles																					
% Passenger Vehicles	99.2	95.7	99	100	98.8	99.6	99.2	94.9	0	98.9	0	0	0	100	100	96.7	99.1	99.6	100	99.1	98.9
SU Trucks & Buses	10	9	7	0	26	2	12	11	0	25	0	0	0	0	0	9	15	5	0	29	80
% SU Trucks & Buses	0.8	4.3	1	0	1.2	0.3	0.8	5.1	0	1	0	0	0	0	0	3.3	0.9	0.4	0	0.9	1
MU Trucks	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	2
% MU Trucks	0	0	0	0	0	0.1	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0

Manual Turning Movement Count

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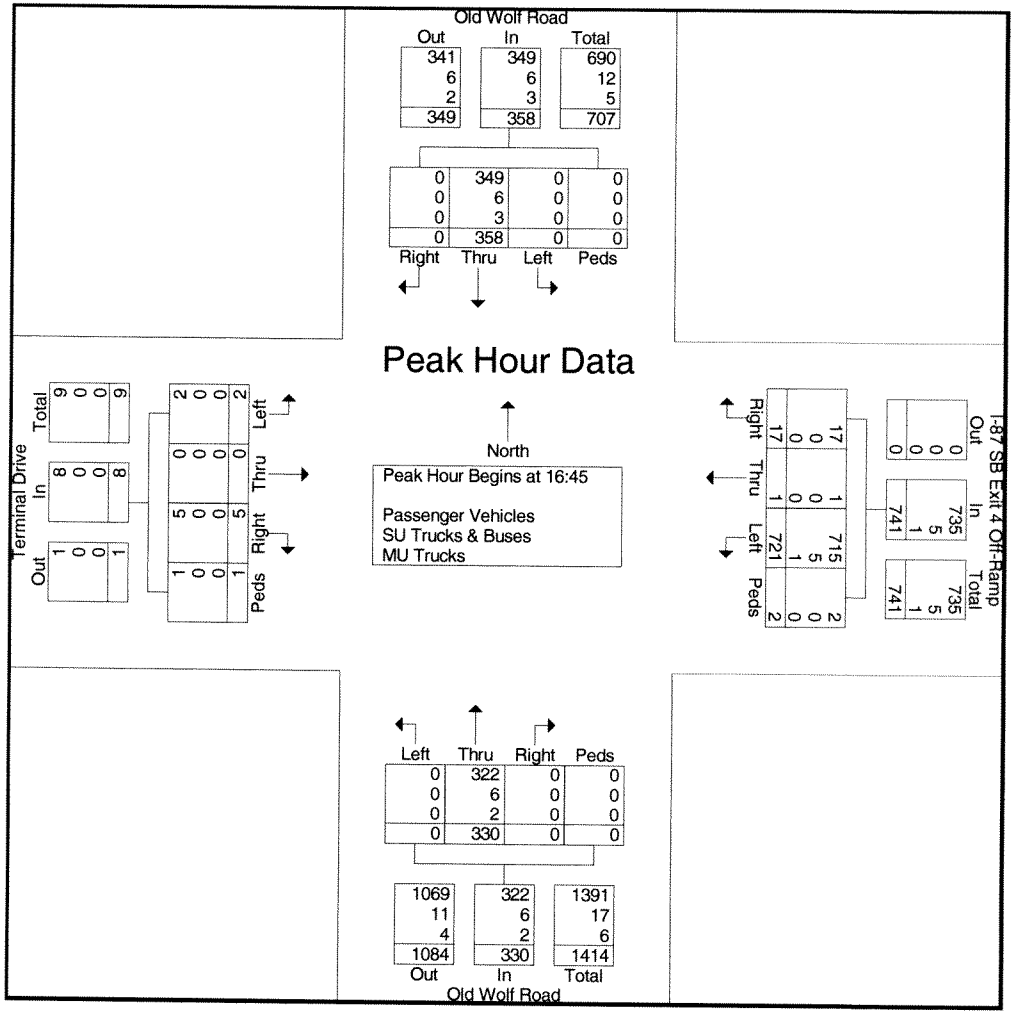
Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
PM
4 to 6

File Name : Old Wolf - Exit 4 SB PM
Site Code : 62906008
Start Date : 6/29/2006
Page No : 4



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Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
PM
4 to 6

File Name : Old Wolf - Exit 4 SB PM
Site Code : 62906008
Start Date : 6/29/2006
Page No : 3

	Old Wolf Road Southbound					I-87 SB Exit 4 Off-Ramp Westbound					Old Wolf Road Northbound					Terminal Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:45																					
16:45	0	96	0	0	96	180	0	4	**1**										**1**	**2**	**368**
17:00	0	**115**	0	0	**115**	166	**1**	3	0	170	0	67	0	0	67	**1**	0	1	0	2	354
17:15	0	91	0	0	91	174	0	**7**	1	182	0	**93**	0	0	**93**	0	0	**2**	0	2	368
17:30	0	56	0	0	56	**201**	0	3	0	**204**	0	85	0	0	85	1	0	1	0	2	347
Total Volume	0	358	0	0	358	721	1	17	2	741	0	330	0	0	330	2	0	5	1	8	1437
% App. Total	0	100	0	0		97.3	0.1	2.3	0.3		0	100	0	0		25	0	62.5	12.5		
PHF	.000	.778	.000	.000	.778	.897	.250	.607	.500	.908	.000	.887	.000	.000	.887	.500	.000	.625	.250	1.000	.976
Passenger Vehicles	0	349	0	0	349	715	1	17	2	735	0	322	0	0	322	2	0	5	1	8	1414
% Passenger Vehicles	0	97.5	0	0	97.5	99.2	100	100	100	99.2	0	97.6	0	0	97.6	100	0	100	100	100	98.4
SU Trucks & Buses	0	6	0	0	6	5	0	0	0	5	0	6	0	0	6	0	0	0	0	0	17
% SU Trucks & Buses	0	1.7	0	0	1.7	0.7	0	0	0	0.7	0	1.8	0	0	1.8	0	0	0	0	0	1.2
MU Trucks	0	3	0	0	3	1	0	0	0	1	0	2	0	0	2	0	0	0	0	0	6
% MU Trucks	0	0.8	0	0	0.8	0.1	0	0	0	0.1	0	0.6	0	0	0.6	0	0	0	0	0	0.4

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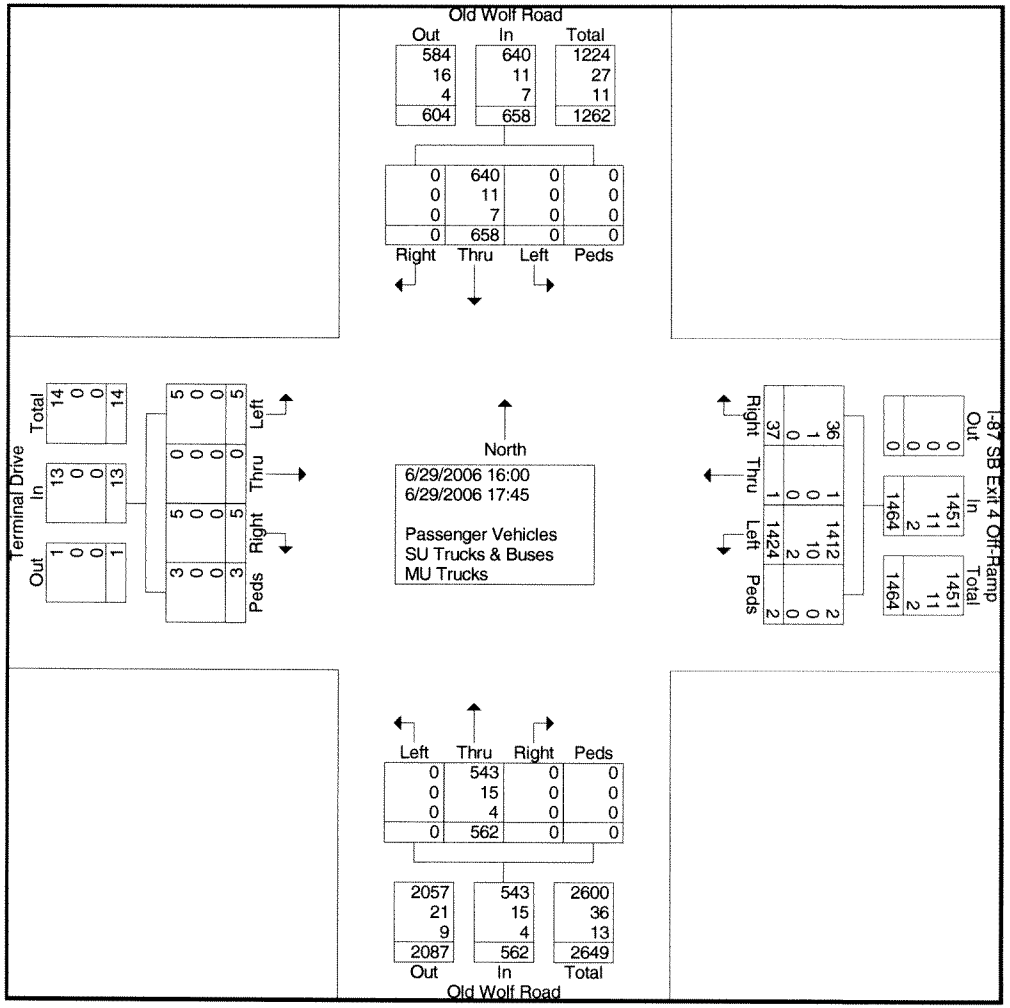
Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
PM
4 to 6

File Name : Old Wolf - Exit 4 SB PM
Site Code : 62906008
Start Date : 6/29/2006
Page No : 2



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Exit 3 Airport Connector
Old Wolf Rd & I-87 SB Exit 4 Off-Ramp
PM
4 to 6

File Name : Old Wolf - Exit 4 SB PM
Site Code : 62906008
Start Date : 6/29/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Old Wolf Road Southbound					I-87 SB Exit 4 Off-Ramp Westbound					Old Wolf Road Northbound					Terminal Drive Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
16:00	0	91	0	0	91	181	0	9	0	190	0	44	0	0	44	1	0	0	0	1	326
16:15	0	71	0	0	71	158	0	6	0	164	0	63	0	0	63	1	0	0	1	2	300
16:30	0	92	0	0	92	165	0	3	0	168	0	54	0	0	54	1	0	0	0	1	315
16:45	0	96	0	0	96	180	0	4	1	185	0	85	0	0	85	0	0	1	1	2	368
Total	0	350	0	0	350	684	0	22	1	707	0	246	0	0	246	3	0	1	2	6	1309
17:00	0	115	0	0	115	166	1	3	0	170	0	67	0	0	67	1	0	1	0	2	354
17:15	0	91	0	0	91	174	0	7	1	182	0	93	0	0	93	0	0	2	0	2	368
17:30	0	56	0	0	56	201	0	3	0	204	0	85	0	0	85	1	0	1	0	2	347
17:45	0	46	0	0	46	199	0	2	0	201	0	71	0	0	71	0	0	0	1	1	319
Total	0	308	0	0	308	740	1	15	1	757	0	316	0	0	316	2	0	4	1	7	1388
Grand Total	0	658	0	0	658	1424	1	37	2	1464	0	562	0	0	562	5	0	5	3	13	2697
Apprch %	0	100	0	0		97.3	0.1	2.5	0.1		0	100	0	0		38.5	0	38.5	23.1		
Total %	0	24.4	0	0	24.4	52.8	0	1.4	0.1	54.3	0	20.8	0	0	20.8	0.2	0	0.2	0.1	0.5	
Passenger Vehicles																					
% Passenger Vehicles	0	97.3	0	0	97.3	99.2	100	97.3	100	99.1	0	96.6	0	0	96.6	100	0	100	100	100	98.1
SU Trucks & Buses	0	11	0	0	11	10	0	1	0	11	0	15	0	0	15	0	0	0	0	0	37
% SU Trucks & Buses	0	1.7	0	0	1.7	0.7	0	2.7	0	0.8	0	2.7	0	0	2.7	0	0	0	0	0	1.4
MU Trucks	0	7	0	0	7	2	0	0	0	2	0	4	0	0	4	0	0	0	0	0	13
% MU Trucks	0	1.1	0	0	1.1	0.1	0	0	0	0.1	0	0.7	0	0	0.7	0	0	0	0	0	0.5

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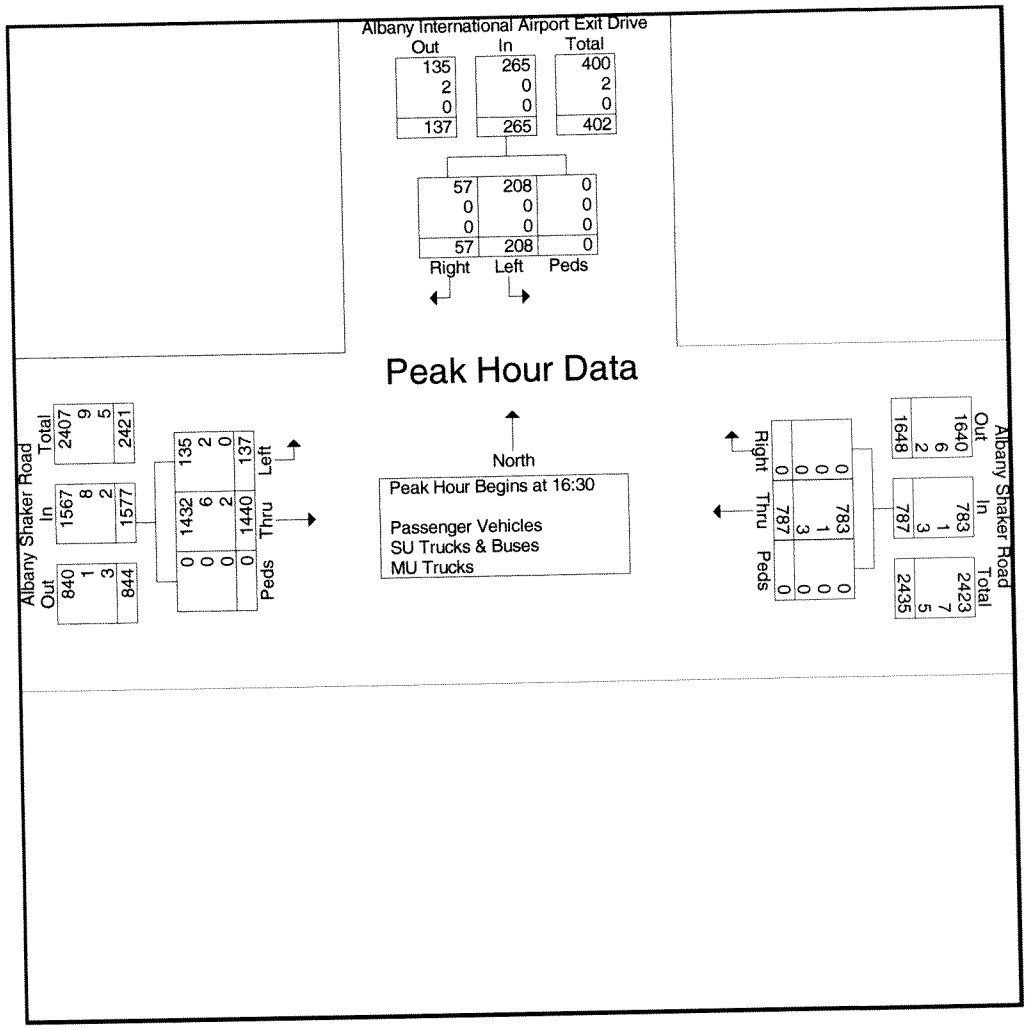
Exit 3 Airport Connector
Albany Shaker & Alb Int Terminal
PM
4 to 6

File Name : Albany Shaker - Alb Int Term Access PM
Site Code : 71106010
Start Date : 7/11/2006
Page No : 4



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PM
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	Albany International Airport Exit Drive Southbound					Albany Shaker Road Westbound					Albany Shaker Road Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:30																					
16:30	**68**		**20**		**88**												**428**			**464**	**738**
16:45	34	0	12	0	46	0	191	0	0	191	0	0	0	0	0	**38**	336	0	0	374	611
17:00	52	0	19	0	71	**1**	**217**	0	0	**218**	0	0	0	0	0	30	349	0	0	379	668
17:15	54	0	6	0	60	0	193	0	0	193	0	0	0	0	0	33	327	0	0	360	613
Total Volume	208	0	57	0	265	1	787	0	0	788	0	0	0	0	0	137	1440	0	0	1577	2630
% App. Total	78.5	0	21.5	0		0.1	99.9	0	0		0	0	0	0		8.7	91.3	0	0		
PHF	.765	.000	.713	.000	.753	.250	.907	.000	.000	.904	.000	.000	.000	.000	.000	.901	.841	.000	.000	.850	.891
Passenger Vehicles	208	0	57	0	265	1	783	0	0	784	0	0	0	0	0	135	1432	0	0	1567	2616
% Passenger Vehicles	100	0	100	0	100	100	99.5	0	0	99.5	0	0	0	0	0	98.5	99.4	0	0	99.4	99.5
SU Trucks & Buses	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	6	0	0	8	9
% SU Trucks & Buses	0	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0	1.5	0.4	0	0	0.5	0.3
MU Trucks	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5
% MU Trucks	0	0	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0	0.1	0	0	0.1	0.2

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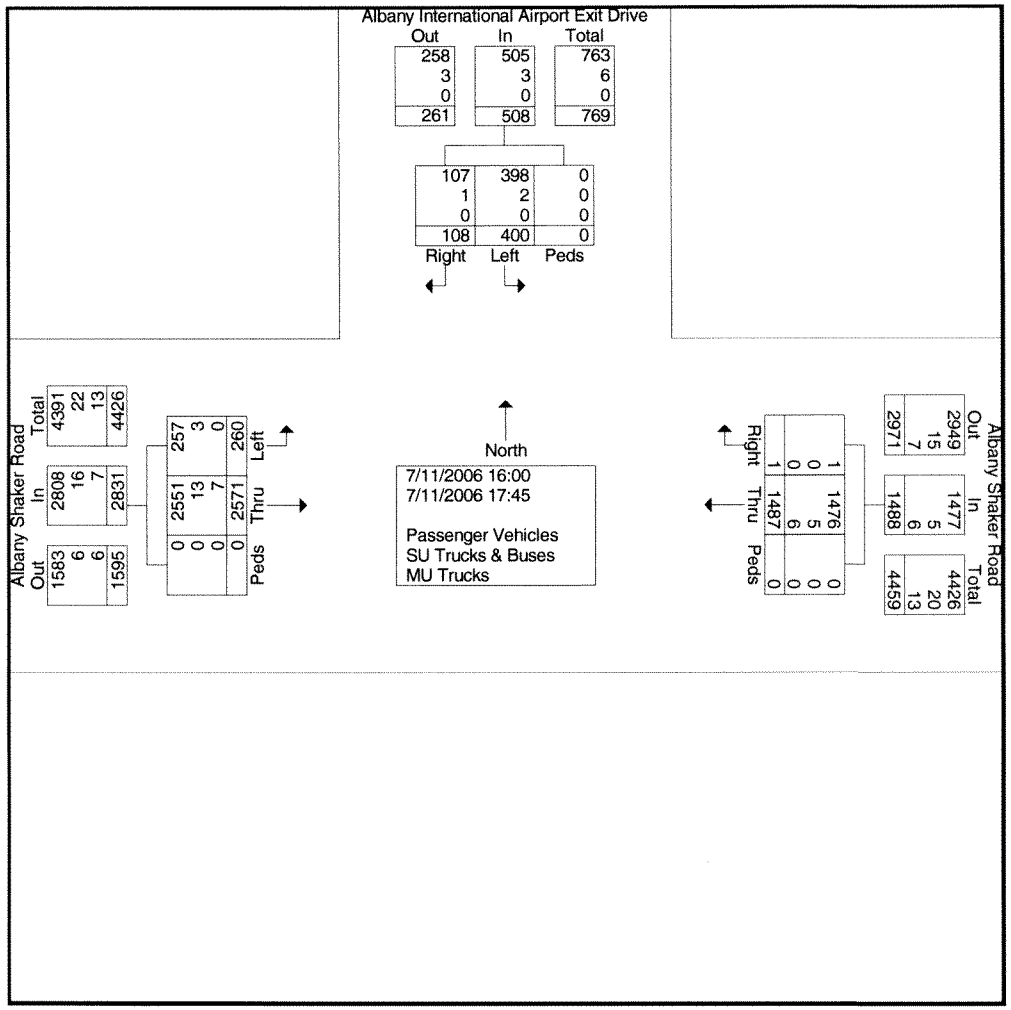

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PM
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File Name : Albany Shaker - Alb Int Term Access PM
Site Code : 71106010
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Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Albany International Airport Exit Drive Southbound					Albany Shaker Road Westbound					Albany Shaker Road Eastbound										
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
16:00	48	0	8	0	56	0	178	1	0	179	0	0	0	0	0	40	348	0	0	388	623
16:15	55	0	15	0	70	1	203	0	0	204	0	0	0	0	0	25	267	0	0	292	566
16:30	68	0	20	0	88	0	186	0	0	186	0	0	0	0	0	36	428	0	0	464	738
16:45	34	0	12	0	46	0	191	0	0	191	0	0	0	0	0	38	336	0	0	374	611
Total	205	0	55	0	260	1	758	1	0	760	0	0	0	0	0	139	1379	0	0	1518	2538
17:00	52	0	19	0	71	1	217	0	0	218	0	0	0	0	0	30	349	0	0	379	668
17:15	54	0	6	0	60	0	193	0	0	193	0	0	0	0	0	33	327	0	0	360	613
17:30	41	0	13	0	54	0	176	0	0	176	0	0	0	0	0	34	265	0	0	299	529
17:45	48	0	15	0	63	0	143	0	0	143	0	0	0	0	0	24	251	0	0	275	481
Total	195	0	53	0	248	1	729	0	0	730	0	0	0	0	0	121	1192	0	0	1313	2291
Grand Total	400	0	108	0	508	2	1487	1	0	1490	0	0	0	0	0	260	2571	0	0	2831	4829
Apprch %	78.7	0	21.3	0		0.1	99.8	0.1	0		0	0	0	0		9.2	90.8	0	0		
Total %	8.3	0	2.2	0	10.5	0	30.8	0	0	30.9	0	0	0	0	0	5.4	53.2	0	0	58.6	
Passenger Vehicles																					
% Passenger Vehicles	99.5	0	99.1	0	99.4	100	99.3	100	0	99.3	0	0	0	0	0	98.8	99.2	0	0	99.2	99.2
SU Trucks & Buses	2	0	1	0	3	0	5	0	0	5	0	0	0	0	0	3	13	0	0	16	24
% SU Trucks & Buses	0.5	0	0.9	0	0.6	0	0.3	0	0	0.3	0	0	0	0	0	1.2	0.5	0	0	0.6	0.5
MU Trucks	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	7	0	0	7	13
% MU Trucks	0	0	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0	0.3	0	0	0.2	0.3

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Exit 3 Airport Connector
Albany Shaker & Watervliet Shaker
PM
4 to 6

File Name : Albany Shaker - Watervliet Shaker PM
Site Code : 62806002
Start Date : 6/28/2006
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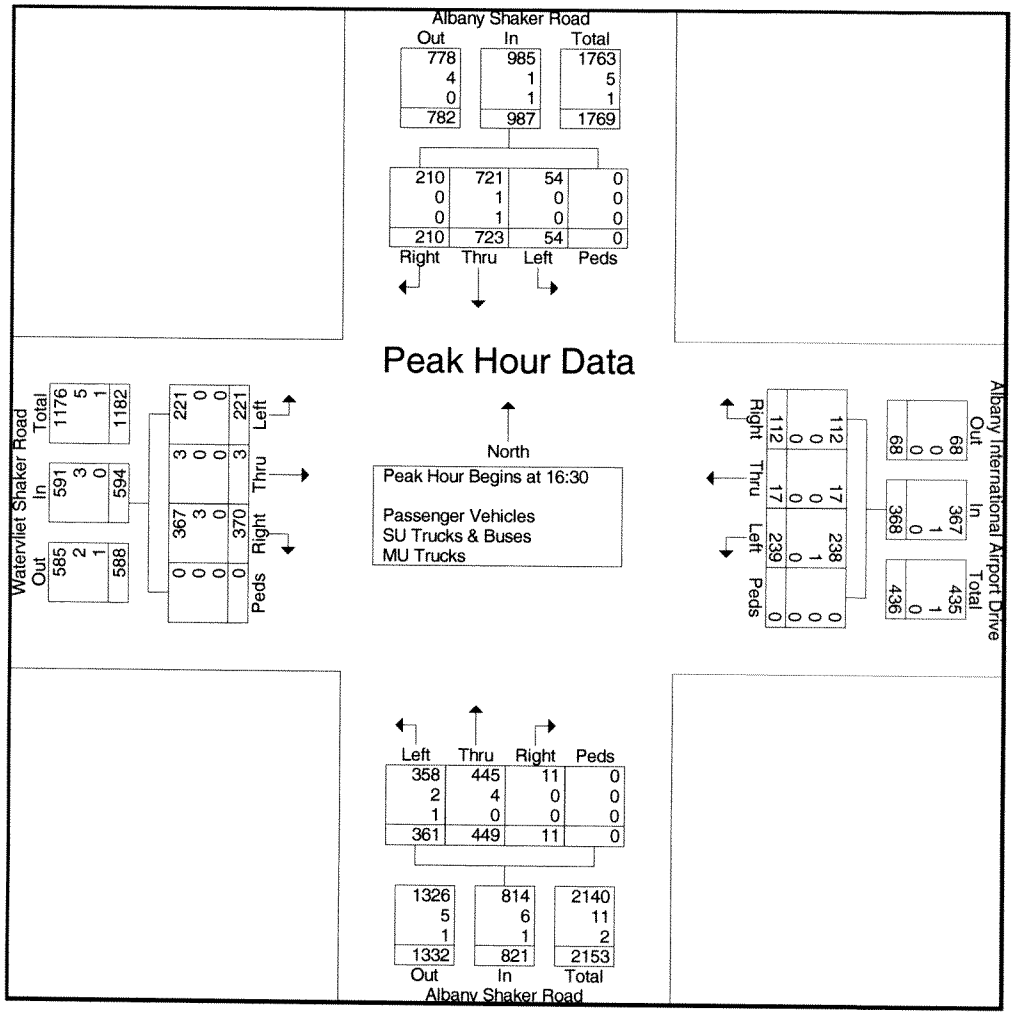

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File Name : Albany Shaker - Watervliet Shaker PM
Site Code : 62806002
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Exit 3 Airport Connector
Albany Shaker & Watervliet Shaker
PM
4 to 6

	Albany Shaker Road Southbound					Albany International Airport Drive Westbound					Albany Shaker Road Northbound					Watervliet Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:30																					
16:30	16	165	57	0	238	54	**7**	**32**	0	**100**	89	111	2	0	202	**61**	**2**	0	139	670
16:45	**17**	168	44	0	229	**72**	2	26	0	85	70	118	**5**	0	193	56	0	78	0	**721**
17:00	11	**200**	**66**	0	**277**	56	3	26	0	90	**102**	**123**	1	0	**226**	60	1	**109**	0	166	712
17:15	10	190	43	0	243	57	5	28	0	368	361	449	11	0	821	221	0	93	0	153	2770
Total Volume	54	723	210	0	987	239	17	112	0		44	54.7	1.3	0		37.2	3	370	0	594	
% App. Total	5.5	73.3	21.3	0		64.9	4.6	30.4	0	.920	.885	.913	.550	.000	.908	.906	.375	62.3	.000		.960
PHF	.794	.904	.795	.000	.891	.830	.607	.875	.000	367	358	445	11	0	814	221	3	.849	0	.895	2757
Passenger Vehicles	54	721	210	0	985	238	17	112	0	99.7	99.2	99.1	100	0	99.1	100	100	367	0	591	99.5
% Passenger Vehicles	100	99.7	100	0	99.8	99.6	100	100	0	1	2	4	0	0	6	0	0	99.2	0	99.5	11
SU Trucks & Buses	0	1	0	0	1	1	0	0	0	0.3	0.6	0.9	0	0	0.7	0	0	3	0	3	0.4
% SU Trucks & Buses	0	0.1	0	0	0.1	0.4	0	0	0	0	1	0	0	0	1	0	0	0.8	0	0.5	2
MU Trucks	0	1	0	0	1	0	0	0	0	0	0.3	0	0	0	0.1	0	0	0	0	0	0.1
% MU Trucks	0	0.1	0	0	0.1	0	0	0	0	0						0	0	0	0	0	

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PM
4 to 6

File Name : Albany Shaker - Watervliet Shaker PM
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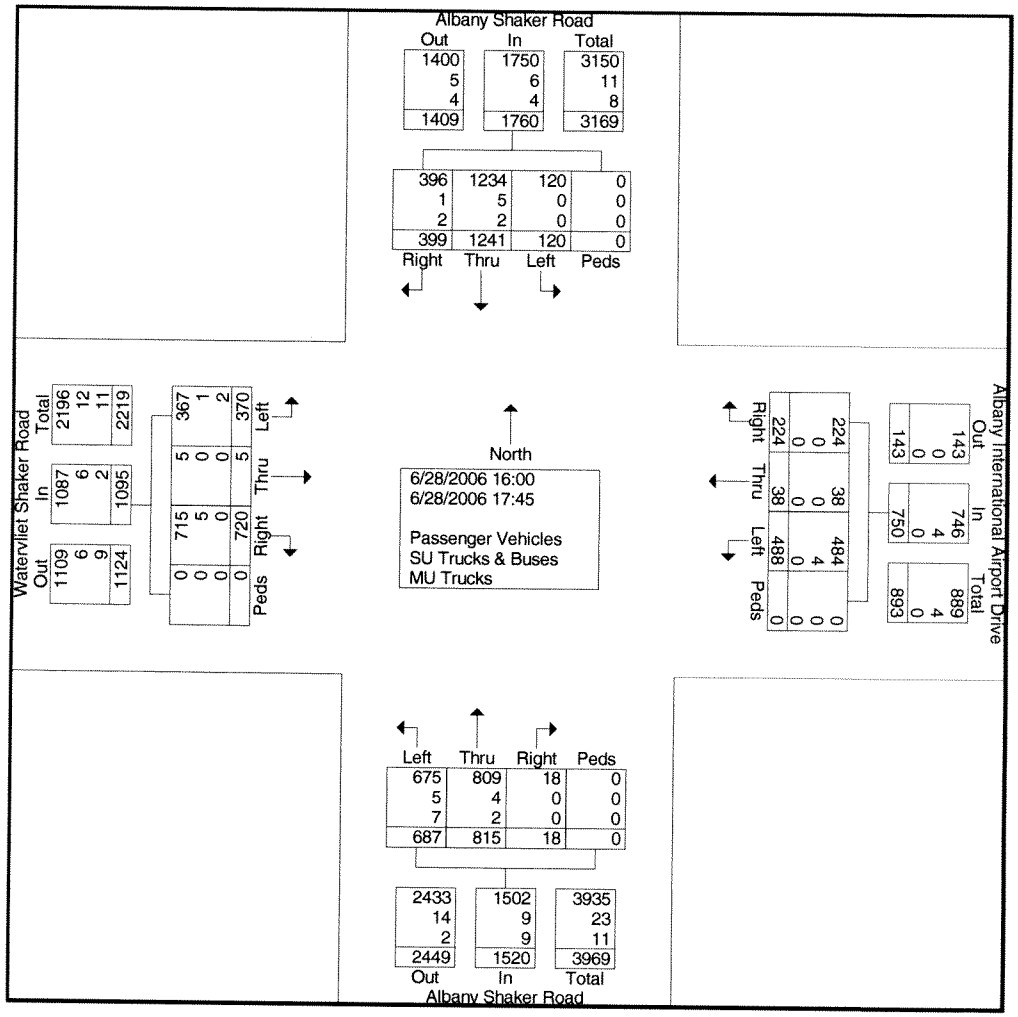

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Albany Shaker & Watervliet Shaker
PM
4 to 6

File Name : Albany Shaker - Watervliet Shaker PM
Site Code : 62806002
Start Date : 6/28/2006
Page No : 1

Groups Printed- Passenger Vehicles - SU Trucks & Buses - MU Trucks

	Albany Shaker Road Southbound					Albany International Airport Drive Westbound					Albany Shaker Road Northbound					Watervliet Shaker Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
16:00	18	140	42	0	200	85	6	41	0	132	62	87	2	0	151	39	1	86	0	126	609
16:15	25	138	53	0	216	50	6	25	0	81	83	87	1	0	171	29	0	94	0	123	591
16:30	16	165	57	0	238	54	7	32	0	93	100	97	3	0	200	44	2	90	0	136	667
16:45	17	168	44	0	229	72	2	26	0	100	89	111	2	0	202	61	0	78	0	139	670
Total	76	611	196	0	883	261	21	124	0	406	334	382	8	0	724	173	3	348	0	524	2537
17:00	11	200	66	0	277	56	3	26	0	85	70	118	5	0	193	56	1	109	0	166	721
17:15	10	190	43	0	243	57	5	28	0	90	102	123	1	0	226	60	0	93	0	153	712
17:30	13	140	44	0	197	63	5	24	0	92	96	96	0	0	192	49	1	83	0	133	614
17:45	10	100	50	0	160	51	4	22	0	77	85	96	4	0	185	32	0	87	0	119	541
Total	44	630	203	0	877	227	17	100	0	344	353	433	10	0	796	197	2	372	0	571	2588
Grand Total	120	1241	399	0	1760	488	38	224	0	750	687	815	18	0	1520	370	5	720	0	1095	5125
Apprch %	6.8	70.5	22.7	0		65.1	5.1	29.9	0		45.2	53.6	1.2	0		33.8	0.5	65.8	0		
Total %	2.3	24.2	7.8	0	34.3	9.5	0.7	4.4	0	14.6	13.4	15.9	0.4	0	29.7	7.2	0.1	14	0	21.4	
Passenger Vehicles																					
% Passenger Vehicles	100	99.4	99.2	0	99.4	99.2	100	100	0	99.5	98.3	99.3	100	0	98.8	99.2	100	99.3	0	99.3	99.2
SU Trucks & Buses	0	5	1	0	6	4	0	0	0	4	5	4	0	0	9	1	0	5	0	6	25
% SU Trucks & Buses	0	0.4	0.3	0	0.3	0.8	0	0	0	0.5	0.7	0.5	0	0	0.6	0.3	0	0.7	0	0.5	0.5
MU Trucks	0	2	2	0	4	0	0	0	0	0	7	2	0	0	9	2	0	0	0	2	15
% MU Trucks	0	0.2	0.5	0	0.2	0	0	0	0	0	1	0.2	0	0	0.6	0.5	0	0	0	0.2	0.3

ATTACHMENT C
MICROSIMULATION CALIBRATION GUIDELINES

Calibration Criteria

Criteria and Measures	Calibration Acceptance Targets
Hourly Flows, Model Versus Observed	
Individual Link Flows	
Within 15%, for 700 veh/h < Flow < 2700 veh/h	>85% of cases
Within 100 veh/h, for Flow < 700 veh/h	>85% of cases
Within 400 veh/h, for Flow > 2700 veh/h	>85% of cases
Sum of All Link Flows	Within 5% of sum of all link counts
GEH Statistic < 5 for Individual Link Flows	>85% of cases
GEH Statistic for Sum of All Link Flows	GEH < 4 for sum of all link counts
Travel Times, Model Versus Observed	
Journey Times, Network	
Within 15% (or 1 min, if higher)	>85% of cases
Visual Audits	
Individual Link Speeds	
Visually Acceptable Speed-Flow Relationship	To analyst's satisfaction
Bottlenecks	
Visually Acceptable Queuing	To analyst's satisfaction

Source: Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, Publication No. FHWA-HRT-04-040, Federal Highway Administration, July 2004.

ATTACHMENT D
LEVEL OF SERVICE CRITERIA

From the Highway Capacity Manual 2000 published by the Transportation Research Board:

Signalized Intersections

TABLE A HCS SIGNALIZED LOS STANDARDS	
LOS	Control Delay per Vehicle (s/veh)
A	10 or less
B	10 – 20
C	20 - 35
D	35 – 55
E	55 - 80
F	greater than 80

* s/veh = seconds per vehicle

LOS A describes operations with low control delay, up to 10 s/veh. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

LOS B describes operations with control delay greater than 10 and up to 20 s/veh. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

LOS C describes operations with control delay greater than 20 and up to 35 s/veh. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with control delay greater than 35 and up to 55 s/veh. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity (v/c) ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with control delay greater than 55 and up to 80 s/veh. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

LOS F describes operations with delay in excess of 80.0 s/veh. This level, considered unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels. Often, vehicles do not pass through the intersection in one signal cycle.

Unsignalized Intersection Delay

The level of service criteria for an unsignalized intersection differs from that of a signalized intersection because of the expectation that signalized intersections encounter more traffic and therefore greater delays. The thresholds for the levels of service of unsignalized intersections are as follows:

TABLE B HCS UNSIGNALIZED LOS STANDARDS	
LOS	Control Delay per Vehicle (s/veh)
A	10 or less
B	10 – 15
C	15 - 25
D	25 – 35
E	35 - 50
F	greater than 50

* s/veh = seconds per vehicle

Levels-of-service A, B, and C are considered acceptable, LOS D is generally considered marginally acceptable during peak periods and LOS E and F are considered unacceptable.

Freeways

A basic freeway segment can be characterized by three performance measures: density in terms of passenger cars per mile per lane, speed in terms of mean passenger-car sped and volume-to capacity (v/c) ratio. The measure used to provide an estimate of the LOS is density and are as follows:

TABLE C HCS FREEWAY LOS STANDARDS	
LOS	Density (pc/mi/ln)
A	0 – 11
B	11 – 18
C	18 – 26
D	26 – 35
E	35 - 45
F	> 45

Ramps and Ramp Junctions

TABLE D HCS MERGE AND DIVERGE AREA LOS STANDARDS	
LOS	Density (pc/mi/ln)
A	10 or less
B	10 – 20
C	20 - 28
D	28 – 35
E	Greater than 35
F	Demand exceeds capacity

LOS in merge (and diverge) influence areas is determined by density for all cases of stable operation, represented by LOS A through E. LOS F exists when the total flow departing from the merge area exceeds the capacity of the downstream freeway segment.

LOS A represents unrestricted operations. Density is low enough to permit smooth merging and diverging, with virtually no turbulence in the traffic stream.

LOS B, merging and diverging maneuvers become noticeable to through drivers, and minimal turbulence occurs. Merging drivers must adjust speeds to accomplish smooth transitions from the acceleration lane to the freeway.

LOS C, speed within the influence area begins to decline as turbulence levels become noticeable. Both ramp and freeway vehicles begin to adjust their speeds to accomplish smooth transitions.

LOS D, turbulence levels in the influence area become intrusive, and virtually all vehicles slow to accommodate merging and diverging. Some ramp queues may form at heavily used on-ramps, but freeway operations remains stable.

LOS E represents conditions approaching capacity.

Weaving Segments

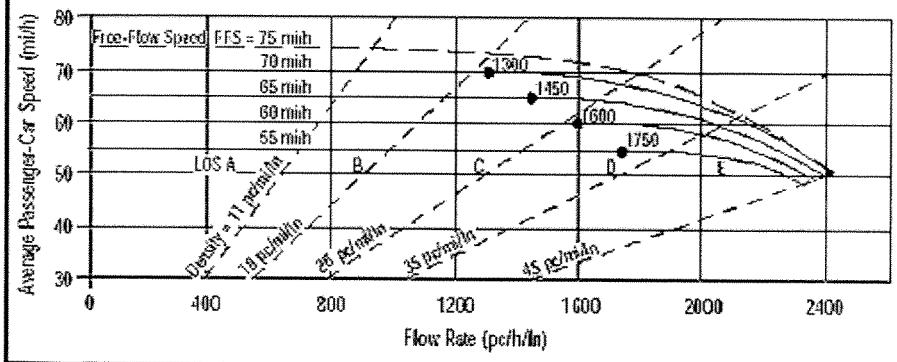
A single LOS is used to characterize total flow in the weaving segment, although it is recognized that in some situations (particularly in cases of constrained operations) nonweaving vehicles may achieve higher-quality operations than weaving vehicles.

TABLE E HCS WEAVE LOS STANDARDS	
LOS	Density (pc/mi/ln)
A	10 or less
B	10 – 20
C	20 - 28
D	28 – 35
E	35 – 43
F	Greater than 43

ATTACHMENT E
LEVEL OF SERVICE WORKSHEETS

EXISTING

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 2 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1098*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*19.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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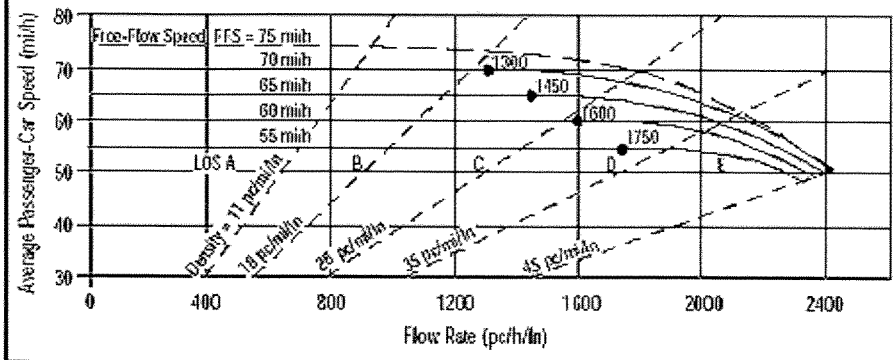
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5150*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1885*	pc/h/ln
S	*55.7*	mi/h
D = v_p / S	*33.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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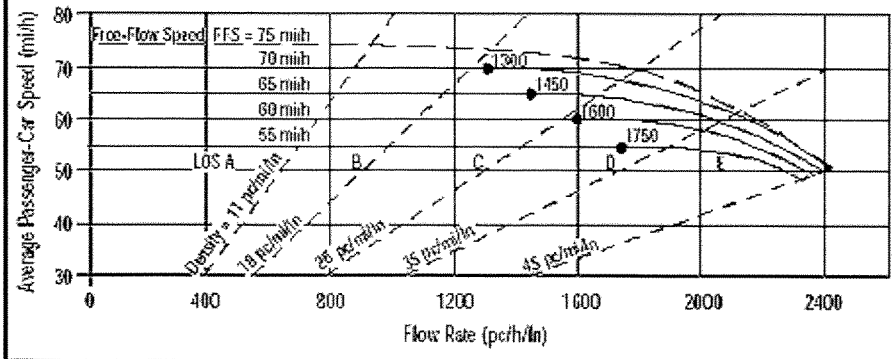

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*805*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*14.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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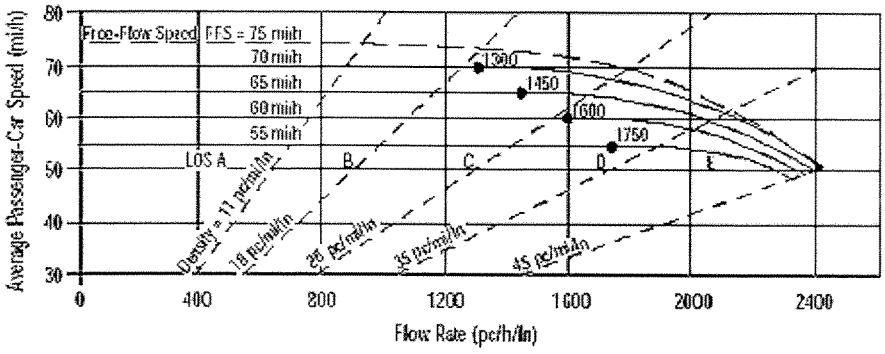

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*12/08/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 on to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1683*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*30.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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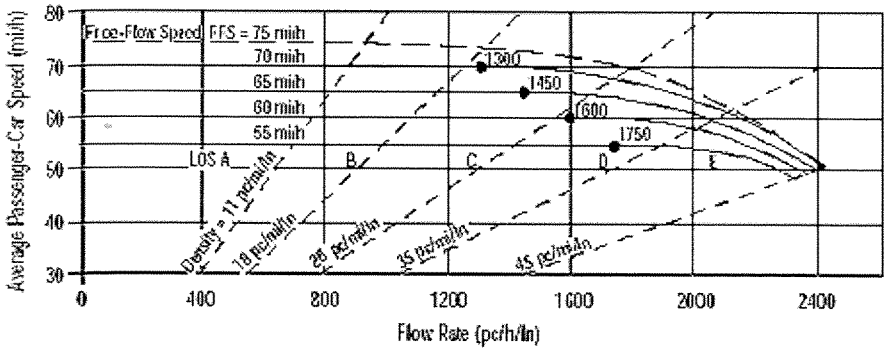

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2700*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*988*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*17.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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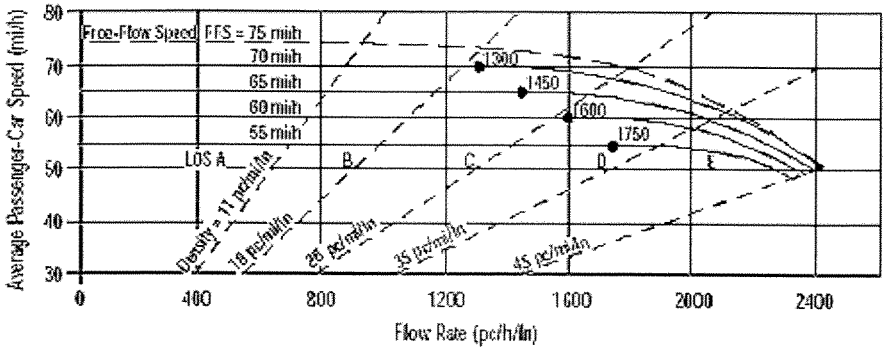

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4400*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1610*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*28.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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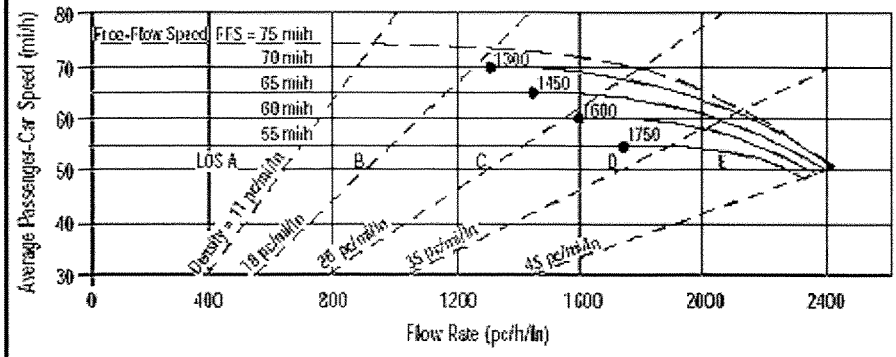
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*686*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*12.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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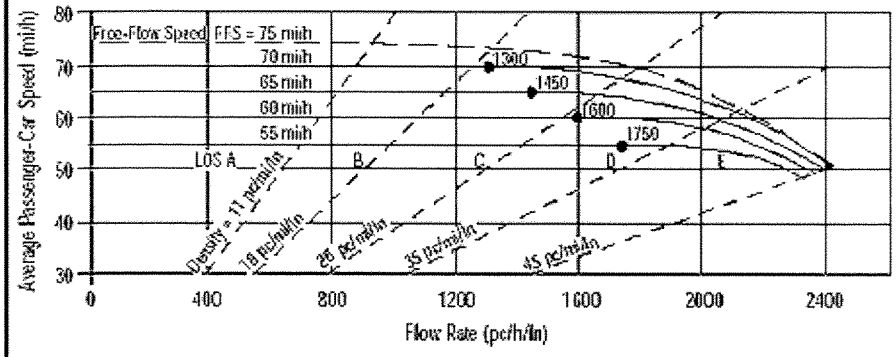
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*9/08/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1674*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*29.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 690 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2650	0.92	Level	2	0	0.990	1.00	2909
Ramp	340	0.92	Level	2	0	0.990	1.00	373
UpStream	690	0.92	Level	2	0	0.990	1.00	757
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 769.55 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1749 pc/h
V_3 or V_{av34} 1160 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3282	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2122	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 16.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.286 (Exibit 25-19)
S_R = 52.0 mph (Exhibit 25-19)
S_0 = 53.6 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 550 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.92	Level	2	0	0.990	1.00	3293
Ramp	810	0.82	Level	2	0	0.990	1.00	998
UpStream								
DownStream	550	0.92	Level	2	0	0.990	1.00	604

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.632 using Equation (Exhibit 25-12)
V_{12} = 2448 pc/h
V_3 or V_{av34} 845 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3293	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2295	Exhibit 25-14	6780	No
V_R	998	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2448	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 22.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)
S_R= 49.7 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 440 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2200	0.92	Level	2	0	0.990	1.00	2415
Ramp	550	0.92	Level	2	0	0.990	1.00	604
UpStream								
DownStream	440	0.96	Level	2	0	0.990	1.00	463

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 2248.66 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1456 pc/h
V_3 or V_{av34} 959 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3019	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2060	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$
D_R = 15.6 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.280 (Exibit 25-19)
S_R= 52.1 mph (Exhibit 25-19)
S_0= 54.3 mph (Exhibit 25-19)
S = 52.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 550 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2700	0.92	Level	2	0	0.990	1.00	2964
Ramp	440	0.96	Level	2	0	0.990	1.00	463
UpStream	550	0.92	Level	2	0	0.990	1.00	604
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 5808.59 (Equation 25-8 or 25-9)
P_{FD} = 0.706 using Equation (Exhibit 25-12)
V_{12} = 2228 pc/h
V_3 or V_{av34} 736 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2964	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2501	Exhibit 25-14	6780	No
V_R	463	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2228	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 21.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.470 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 51.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 310 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5150	0.92	Level	2	0	0.990	1.00	5654
Ramp	890	0.92	Level	2	0	0.990	1.00	977
UpStream								
DownStream	310	0.92	Level	2	0	0.990	1.00	340

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.574 using Equation (Exhibit 25-12)
V_{12} = 3660 pc/h
V_3 or V_{av34} 1994 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5654	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4677	Exhibit 25-14	6780	No
V_R	977	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3660	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.451 (Exhibit 25-19)
S_R = 49.7 mph (Exhibit 25-19)
S_0 = 57.6 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 490 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5500	0.92	Level	2	0	0.990	1.00	6038
Ramp	1070	0.92	Level	2	0	0.990	1.00	1175
UpStream								
DownStream	490	0.93	Level	3	0	0.985	1.00	535

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.555 using Equation (Exhibit 25-12)
V_{12} = 3874 pc/h
V_3 or V_{av34} 2164 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6038	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4863	Exhibit 25-14	6780	No
V_R	1175	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3874	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.469 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 56.9 mph (Exhibit 25-19)
S = 51.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 490 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4600	0.92	Level	2	0	0.990	1.00	5050
Ramp	540	0.93	Level	5	0	0.976	1.00	595
UpStream	490	0.93	Level	3	0	0.985	1.00	535
DownStream								

Merge Areas | Diverge Areas

Estimation of v_{12} (Merge Areas)

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3044 pc/h
V_3 or V_{av34} 2006 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} (Diverge Areas)

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks (Merge Areas)

	Actual	Capacity		LOS F?
V_{FO}	5645	Exhibit 25-7		No

Capacity Checks (Diverge Areas)

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3639	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) (Merge Areas)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 27.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F) (Diverge Areas)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination (Merge Areas)

M_S = 0.397 (Exibit 25-19)
S_R= 50.4 mph (Exhibit 25-19)
S_0= 50.6 mph (Exhibit 25-19)
S = 50.5 mph (Exhibit 25-14)

Speed Determination (Diverge Areas)

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 540 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.92	Level	2	0	0.990	1.00	4830
Ramp	490	0.93	Level	3	0	0.985	1.00	535
UpStream								
DownStream	540	0.93	Level	5	0	0.976	1.00	595

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 2911 pc/h
V_3 or V_{av34} 1919 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	5365	Exhibit 25-7		No

Capacity Checks — Diverge Areas

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3446	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = 0.371 (Exibit 25-19)
S_R= 50.8 mph (Exhibit 25-19)
S_0= 50.9 mph (Exhibit 25-19)
S = 50.8 mph (Exhibit 25-14)

Speed Determination — Diverge Areas

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2009 Existing

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.31
Weaving seg length, L (ft)	815	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2320	0.92	2	0	1.5	1.2	0.990	1.00	2546
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	690	0.92	2	0	1.5	1.2	0.990	1.00	757
V_{w2}	330	0.92	2	0	1.5	1.2	0.990	1.00	362
V_w				1119	V_{nw}				2546
V									3665

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.20	0.27
Weaving and non-weaving speeds, Si (mi/h)			29.36	51.22

Number of lanes required for unconstrained operation, Nw 1.46
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.74
Weaving segment density, D (pc/mi/ln)	21.95
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6158
Capacity as a 15-minute flow rate, c (veh/h)	6097
Capacity as a full-hour volume, c_h (veh/h)	5609

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2009 Existing

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.19
Weaving seg length, L (ft)	810	Weaving ratio, R	0.35
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3680	0.92	2	0	1.5	1.2	0.990	1.00	4039
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	570	0.92	2	0	1.5	1.2	0.990	1.00	625
V_{w2}	310	0.92	2	0	1.5	1.2	0.990	1.00	340
V_w				965	V_{nw}				4039
V									5004

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.05	0.50		
Weaving and non-weaving speeds, Si (mi/h)	37.41	45.75		

Number of lanes required for unconstrained operation, Nw 1.13
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.86
Weaving segment density, D (pc/mi/ln)	28.52
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6776
Capacity as a 15-minute flow rate, c (veh/h)	6709
Capacity as a full-hour volume, c_h (veh/h)	6172

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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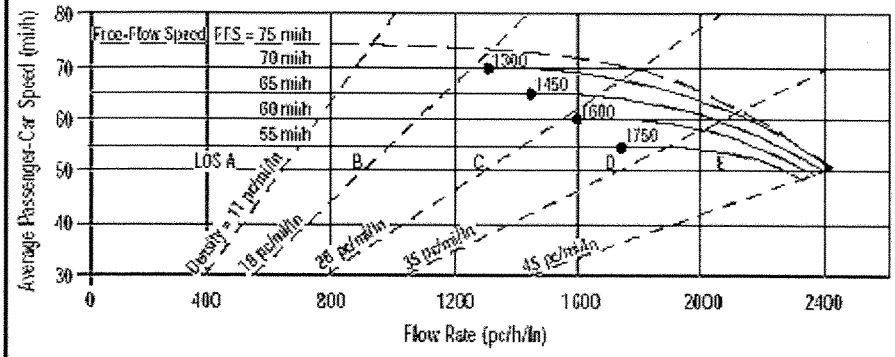
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 2 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5100*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1997*	pc/h/ln
S	*55.0*	mi/h
D = v_p / S	*36.3*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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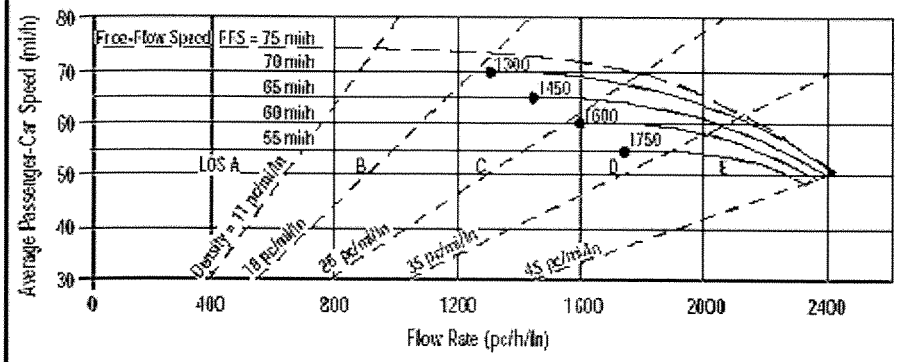
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1372*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*24.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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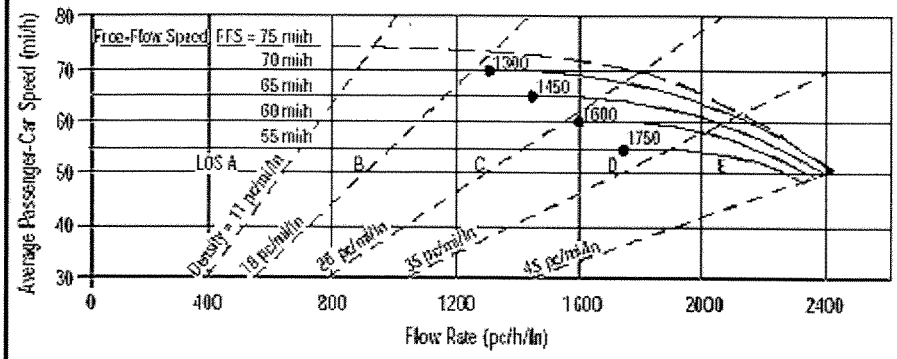
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1762*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*31.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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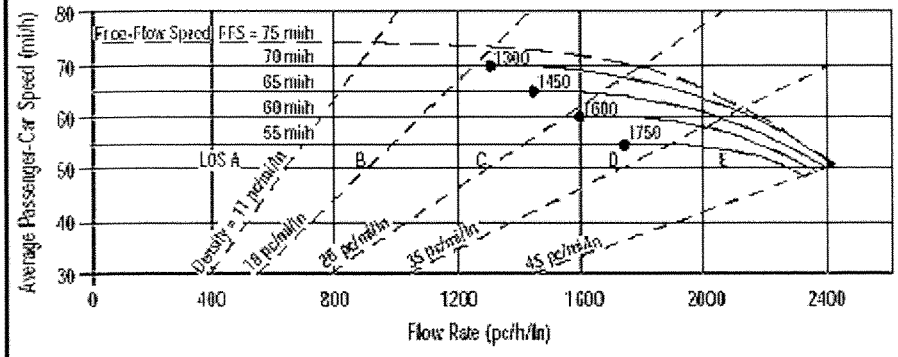
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*12/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 on to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2700*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*988*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*17.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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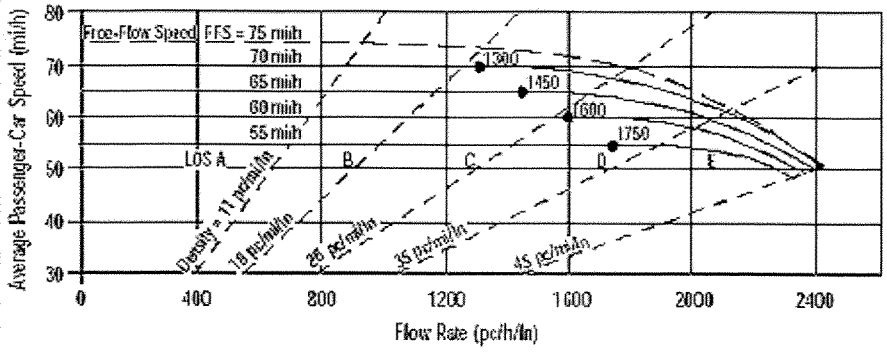
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5800*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2271*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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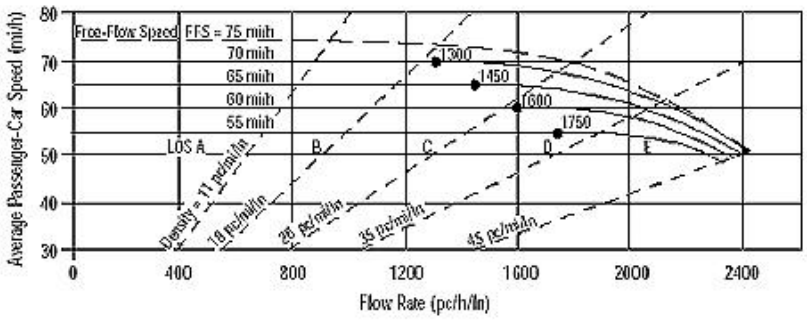
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*9/08/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*915*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*16.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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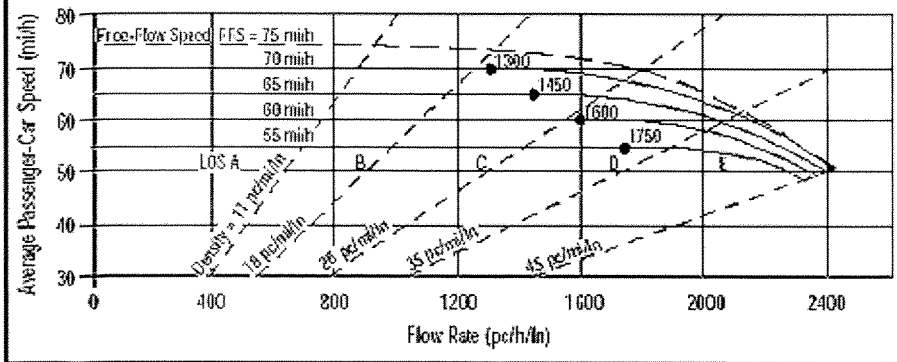

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/08/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6000*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1762*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*31.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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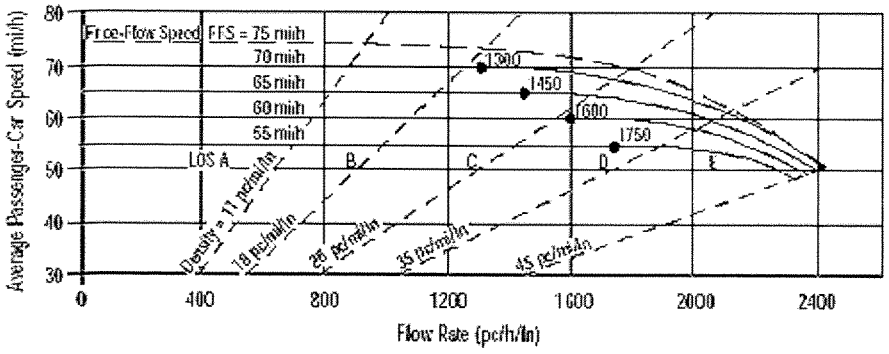
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*9/08/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2009 - Existing*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3300*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*906*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*16.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 910 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.86	Level	2	0	0.990	1.00	5167
Ramp	700	0.92	Level	2	0	0.990	1.00	768
UpStream	910	0.92	Level	2	0	0.990	1.00	999
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1337.29 (Equation 25-2 or 25-3)
P_{FM} = 0.586 using Equation (Exhibit 25-5)
V_{12} = 3029 pc/h
V_3 or V_{av34} 2138 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5935	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3797	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 29.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.427 (Exibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 50.1 mph (Exhibit 25-19)
S = 50.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 1330 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5100	0.86	Level	2	0	0.990	1.00	5990
Ramp	600	0.86	Level	2	0	0.990	1.00	705
UpStream								
DownStream	1330	0.88	Level	1	0	0.995	1.00	1519

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.578 using Equation (Exhibit 25-12)
V_{12} = 3759 pc/h
V_3 or V_{av34} 2231 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5990	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5285	Exhibit 25-14	6780	No
V_R	705	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3759	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.426 (Exhibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 56.6 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 440 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4500	0.86	Level	2	0	0.990	1.00	5285
Ramp	1330	0.88	Level	1	0	0.995	1.00	1519
UpStream								
DownStream	440	0.92	Level	3	0	0.985	1.00	485

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2355.51 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3185 pc/h
V_3 or V_{av34} 2100 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6804	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4704	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 35.8 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.680 (Exibit 25-19)
S_R= 46.5 mph (Exhibit 25-19)
S_0= 50.2 mph (Exhibit 25-19)
S = 47.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 1330 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5800	0.86	Level	2	0	0.990	1.00	6812
Ramp	440	0.92	Level	3	0	0.985	1.00	485
UpStream	1330	0.88	Level	1	0	0.995	1.00	1519
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 7960.55 (Equation 25-8 or 25-9)
P_{FD} = 0.713 using Equation (Exhibit 25-12)
V_{12} = 4999 pc/h
V_3 or V_{av34} 1813 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6812	Exhibit 25-14	6780	Yes
$V_{FO} = V_F - V_R$	6327	Exhibit 25-14	6780	No
V_R	485	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4999	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 45.0 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.472 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 58.3 mph (Exhibit 25-19)
S = 51.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 890 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3750	0.92	Level	2	0	0.990	1.00	4117
Ramp	430	0.92	Level	2	0	0.990	1.00	472
UpStream								
DownStream	890	0.92	Level	2	0	0.990	1.00	977

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.635 using Equation (Exhibit 25-12)
V_{12} = 2788 pc/h
V_3 or V_{av34} 1329 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4117	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3645	Exhibit 25-14	6780	No
V_R	472	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2788	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 25.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.405 (Exhibit 25-19)
S_R = 50.3 mph (Exhibit 25-19)
S_0 = 60.1 mph (Exhibit 25-19)
S = 53.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 490 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2900	0.92	Level	2	0	0.990	1.00	3184
Ramp	730	0.92	Level	2	0	0.990	1.00	801
UpStream								
DownStream	490	0.87	Level	1	0	0.995	1.00	566

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.644 using Equation (Exhibit 25-12)
V_{12} = 2335 pc/h
V_3 or V_{av34} 849 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3184	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2383	Exhibit 25-14	6780	No
V_R	801	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2335	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 20.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.435 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 52.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 490 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2700	0.92	Level	2	0	0.990	1.00	2964
Ramp	1030	0.93	Level	4	0	0.980	1.00	1130
UpStream	490	0.87	Level	1	0	0.995	1.00	566
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1786 pc/h
V_3 or V_{av34} 1178 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4094	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2916	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 22.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.321 (Exibit 25-19)
S_R= 51.5 mph (Exhibit 25-19)
S_0= 53.6 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2009 Existing

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 1030 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2500	0.92	Level	2	0	0.990	1.00	2745
Ramp	490	0.87	Level	1	0	0.995	1.00	566
UpStream								
DownStream	1030	0.93	Level	4	0	0.980	1.00	1130

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1654 pc/h
V_3 or V_{av34} 1091 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3311	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2220	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 16.9 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.285 (Exibit 25-19)
S_R = 52.0 mph (Exhibit 25-19)
S_0 = 53.9 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2009 Existing

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.25
Weaving seg length, L (ft)	815	Weaving ratio, R	0.34
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3930	0.86	2	0	1.5	1.2	0.990	1.00	4615
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	910	0.92	2	0	1.5	1.2	0.990	1.00	999
V_{w2}	470	0.92	2	0	1.5	1.2	0.990	1.00	515
V_w				1514	V_{nw}				4615
V									6129

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.41	0.77		
Weaving and non-weaving speeds, Si (mi/h)	34.12	41.02		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.07
Weaving segment density, D (pc/mi/ln)	39.22
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6482
Capacity as a 15-minute flow rate, c (veh/h)	6418
Capacity as a full-hour volume, c_h (veh/h)	5620

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	6/22/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2009 Existing

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.31
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2900	0.92	2	0	1.5	1.2	0.990	1.00	3183
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	890	0.92	2	0	1.5	1.2	0.990	1.00	977
V_{w2}	400	0.92	2	0	1.5	1.2	0.990	1.00	439
V_w				1416	V_{nw}				3183
V									4599

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.77	0.37
Weaving and non-weaving speeds, Si (mi/h)			27.20	48.65

Number of lanes required for unconstrained operation, Nw 1.51
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.15
Weaving segment density, D (pc/mi/ln)	29.37
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6136
Capacity as a 15-minute flow rate, c (veh/h)	6075
Capacity as a full-hour volume, c_h (veh/h)	5589

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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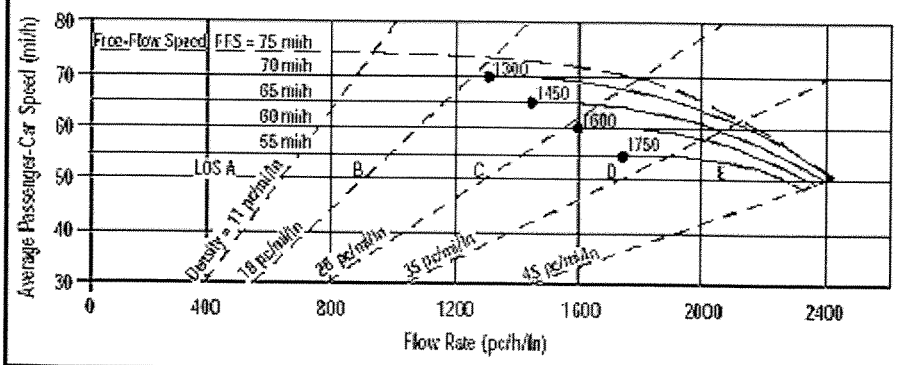
NO-BUILD

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 2 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1098*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*19.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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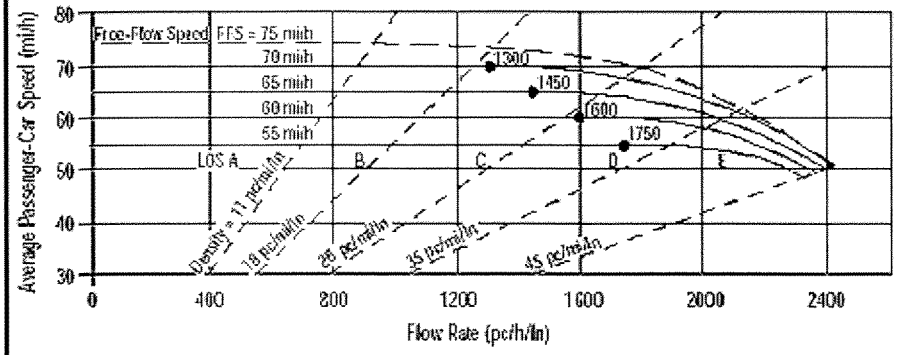
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1903*	pc/h/ln
S	*55.7*	mi/h
D = v_p / S	*34.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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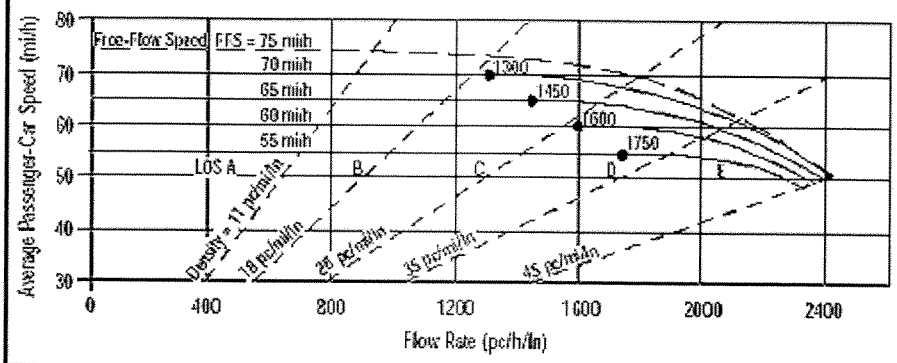
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/09/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2250*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*823*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*14.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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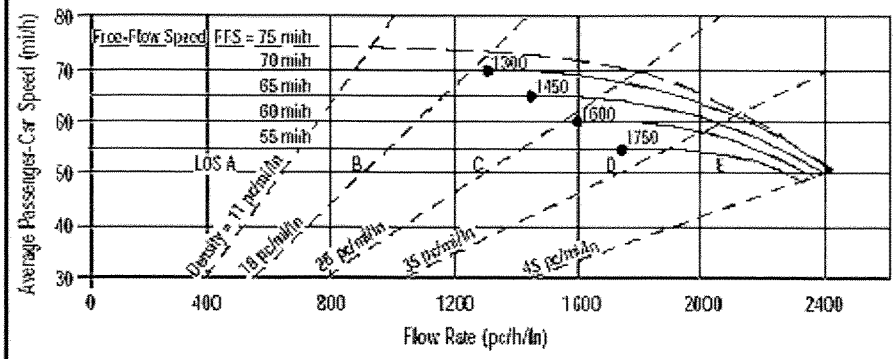
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 on to Exit 4 on*
Date Performed	*12/09/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1702*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*30.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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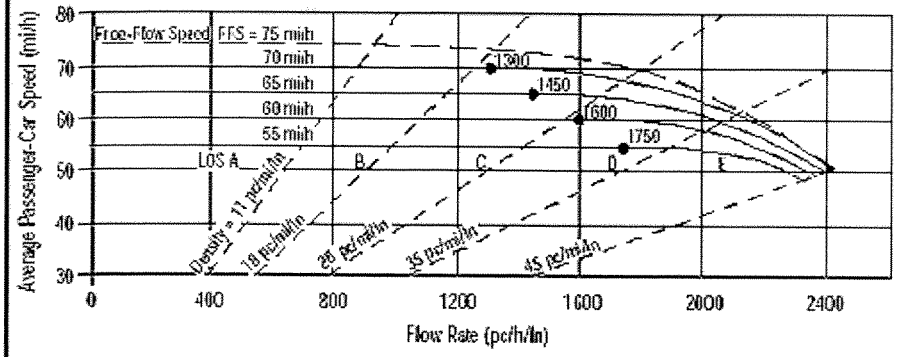
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1006*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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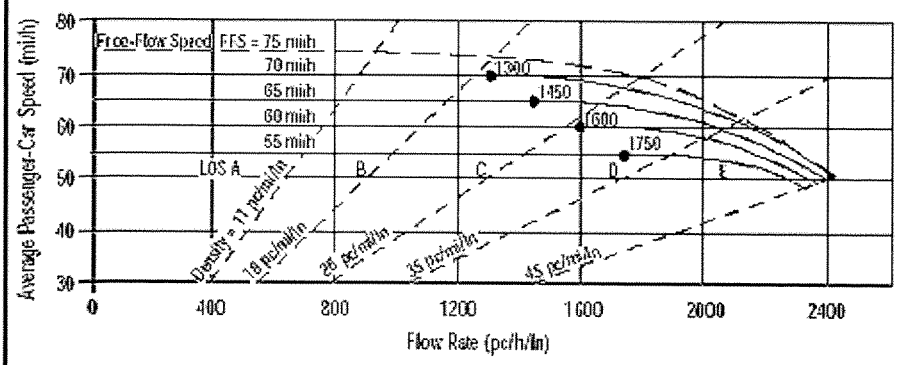
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4400*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1610*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*28.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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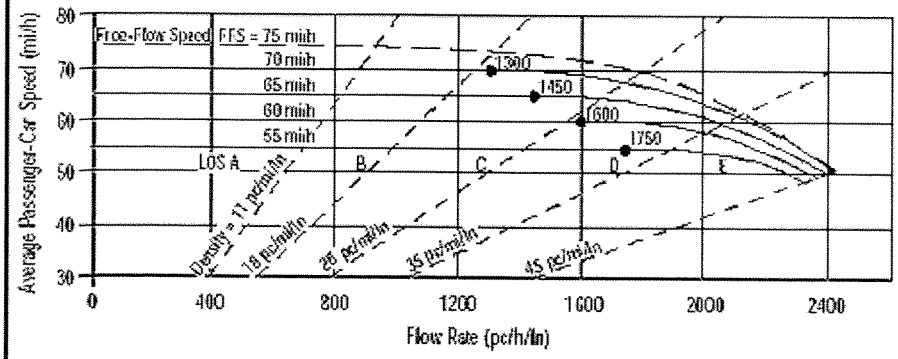
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*686*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*12.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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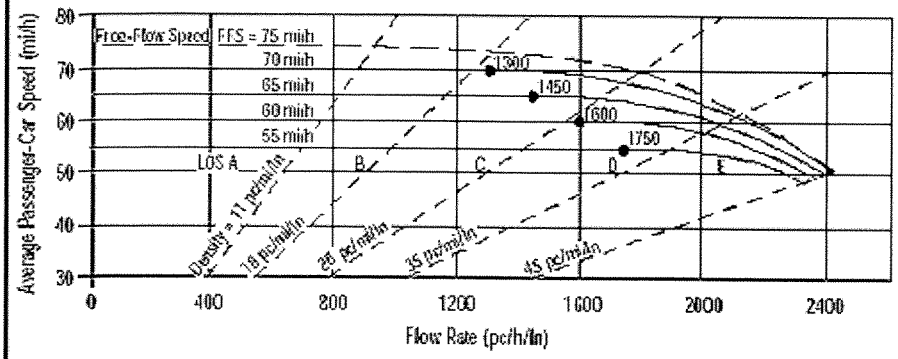
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 6 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1674*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*29.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 620 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2650	0.92	Level	2	0	0.990	1.00	2909
Ramp	350	0.92	Level	2	0	0.990	1.00	384
UpStream	620	0.92	Level	2	0	0.990	1.00	681
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 771.90 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1749 pc/h
V_3 or V_{av34} 1160 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3293	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2133	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 16.6 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.286 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 53.6 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 670 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.92	Level	2	0	0.990	1.00	3293
Ramp	740	0.82	Level	2	0	0.990	1.00	911
UpStream								
DownStream	670	0.92	Level	2	0	0.990	1.00	736

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.636 using Equation (Exhibit 25-12)
V_{12} = 2425 pc/h
V_3 or V_{av34} 868 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3293	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2382	Exhibit 25-14	6780	No
V_R	911	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2425	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 22.0 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.445 (Exhibit 25-19)
S_R = 49.8 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 460 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2250	0.92	Level	2	0	0.990	1.00	2470
Ramp	670	0.92	Level	2	0	0.990	1.00	736
UpStream								
DownStream	460	0.96	Level	2	0	0.990	1.00	484

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 2350.66 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1489 pc/h
V_3 or V_{av34} 981 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3206	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2225	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$
D_R = 16.8 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.285 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 54.3 mph (Exhibit 25-19)
S = 52.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 670 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2750	0.92	Level	2	0	0.990	1.00	3019
Ramp	460	0.96	Level	2	0	0.990	1.00	484
UpStream	670	0.92	Level	2	0	0.990	1.00	736
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 7100.61 (Equation 25-8 or 25-9)
P_{FD} = 0.726 using Equation (Exhibit 25-12)
V_{12} = 2325 pc/h
V_3 or V_{av34} 694 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3019	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2535	Exhibit 25-14	6780	No
V_R	484	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2325	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 22.0 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.472 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 51.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 370 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5200	0.92	Level	2	0	0.990	1.00	5709
Ramp	780	0.92	Level	2	0	0.990	1.00	856
UpStream								
DownStream	370	0.92	Level	2	0	0.990	1.00	406

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.578 using Equation (Exhibit 25-12)
V_{12} = 3661 pc/h
V_3 or V_{av34} 2048 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5709	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4853	Exhibit 25-14	6780	No
V_R	856	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3661	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.440 (Exhibit 25-19)
S_R = 49.8 mph (Exhibit 25-19)
S_0 = 57.3 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 370 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5400	0.92	Level	2	0	0.990	1.00	5928
Ramp	1020	0.92	Level	2	0	0.990	1.00	1120
UpStream								
DownStream	370	0.93	Level	3	0	0.985	1.00	404

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.560 using Equation (Exhibit 25-12)
V_{12} = 3814 pc/h
V_3 or V_{av34} 2114 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5928	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4808	Exhibit 25-14	6780	No
V_R	1120	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3814	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 32.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.464 (Exhibit 25-19)
S_R = 49.5 mph (Exhibit 25-19)
S_0 = 57.1 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 370 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4650	0.92	Level	2	0	0.990	1.00	5105
Ramp	530	0.93	Level	5	0	0.976	1.00	584
UpStream	370	0.93	Level	3	0	0.985	1.00	404
DownStream								

Merge Areas | Diverge Areas

Estimation of v_{12} (Merge Areas)

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3077 pc/h
V_3 or V_{av34} 2028 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} (Diverge Areas)

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks (Merge Areas)

	Actual	Capacity		LOS F?
V_{FO}	5689	Exhibit 25-7		No

Capacity Checks (Diverge Areas)

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3661	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) (Merge Areas)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 28.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F) (Diverge Areas)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination (Merge Areas)

M_S = 0.401 (Exibit 25-19)
S_R= 50.4 mph (Exhibit 25-19)
S_0= 50.5 mph (Exhibit 25-19)
S = 50.4 mph (Exhibit 25-14)

Speed Determination (Diverge Areas)

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 530 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.92	Level	2	0	0.990	1.00	4830
Ramp	370	0.93	Level	3	0	0.985	1.00	404
UpStream								
DownStream	530	0.93	Level	5	0	0.976	1.00	584

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 2911 pc/h
V_3 or V_{av34} 1919 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	5234	Exhibit 25-7		No

Capacity Checks — Diverge Areas

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3315	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 25.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = 0.356 (Exibit 25-19)
S_R= 51.0 mph (Exhibit 25-19)
S_0= 50.9 mph (Exhibit 25-19)
S = 51.0 mph (Exhibit 25-14)

Speed Determination — Diverge Areas

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2016 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.29
Weaving seg length, L (ft)	815	Weaving ratio, R	0.30
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2360	0.92	2	0	1.5	1.2	0.990	1.00	2590
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	670	0.92	2	0	1.5	1.2	0.990	1.00	735
V_{w2}	290	0.92	2	0	1.5	1.2	0.990	1.00	318
V_w				1053	V_{nw}				2590
V									3643

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.13	0.25
Weaving and non-weaving speeds, Si (mi/h)			29.70	51.66

Number of lanes required for unconstrained operation, Nw 1.40
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.56
Weaving segment density, D (pc/mi/ln)	21.40
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6249
Capacity as a 15-minute flow rate, c (veh/h)	6187
Capacity as a full-hour volume, c_h (veh/h)	5692

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CGA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2016 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	810	Weaving ratio, R	0.35
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3700	0.92	2	0	1.5	1.2	0.990	1.00	4061
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	700	0.92	2	0	1.5	1.2	0.990	1.00	768
V_{w2}	370	0.92	2	0	1.5	1.2	0.990	1.00	406
V_w				1174	V_{nw}				4061
V									5235

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.16	0.58		
Weaving and non-weaving speeds, Si (mi/h)	36.26	44.05		

Number of lanes required for unconstrained operation, Nw 1.25
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.02
Weaving segment density, D (pc/mi/ln)	31.14
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6601
Capacity as a 15-minute flow rate, c (veh/h)	6536
Capacity as a full-hour volume, c_h (veh/h)	6013

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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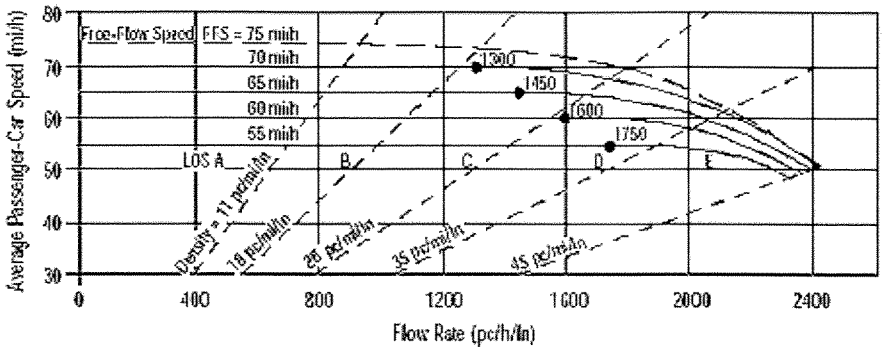
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1098*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*19.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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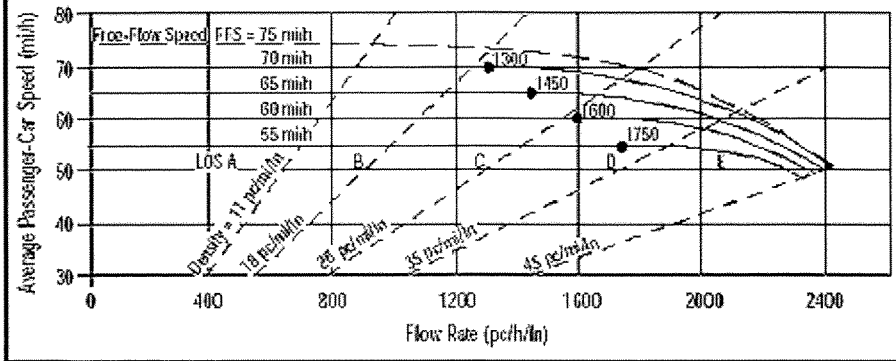
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5250*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1921*	pc/h/ln
S	*55.6*	mi/h
D = v_p / S	*34.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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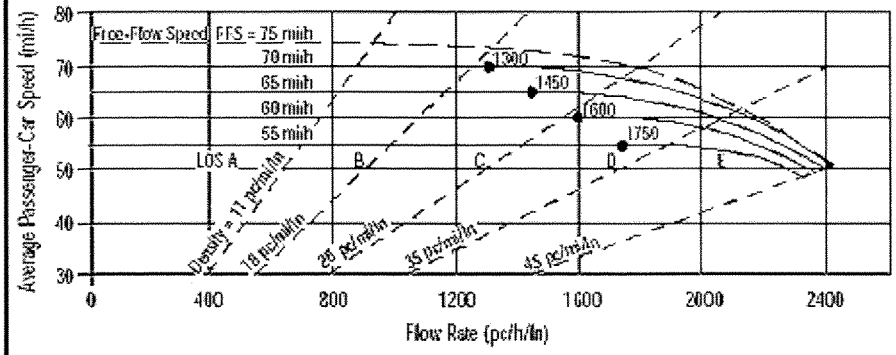
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*9/09/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2250*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	l/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*823*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*14.7*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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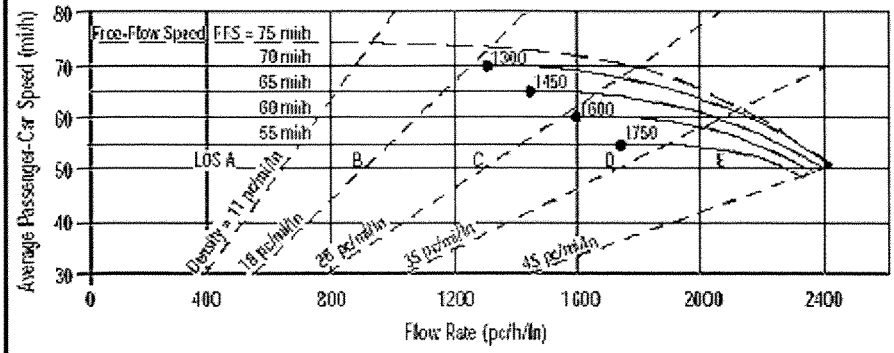

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*12/09/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 on to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1738*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*31.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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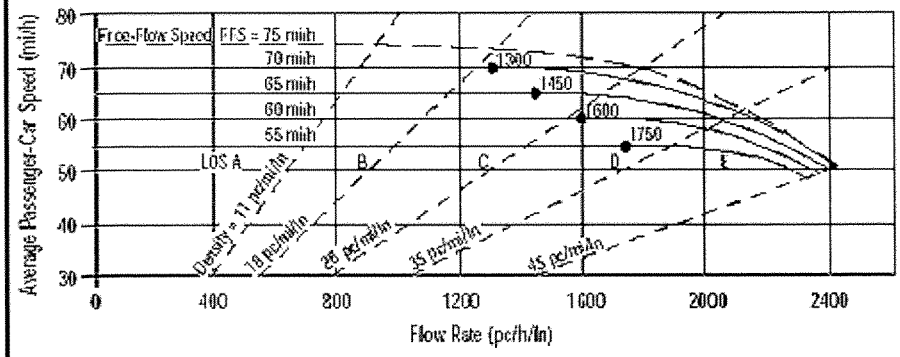

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1006*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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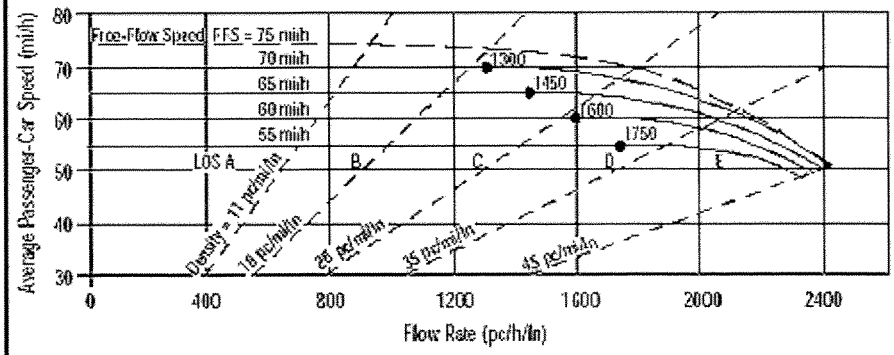

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1628*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*29.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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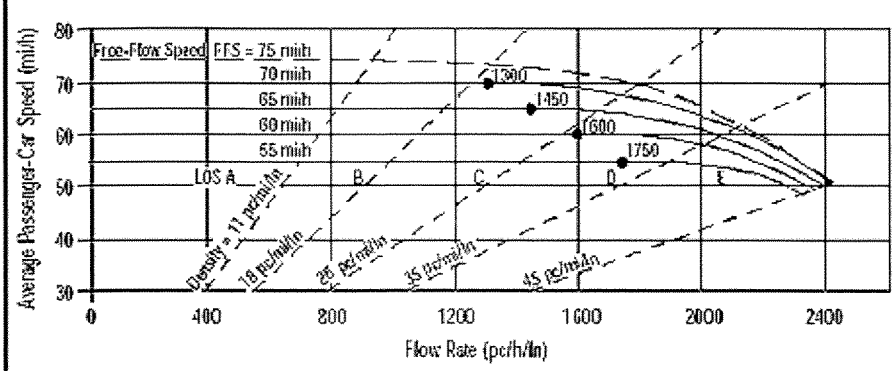

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*700*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*12.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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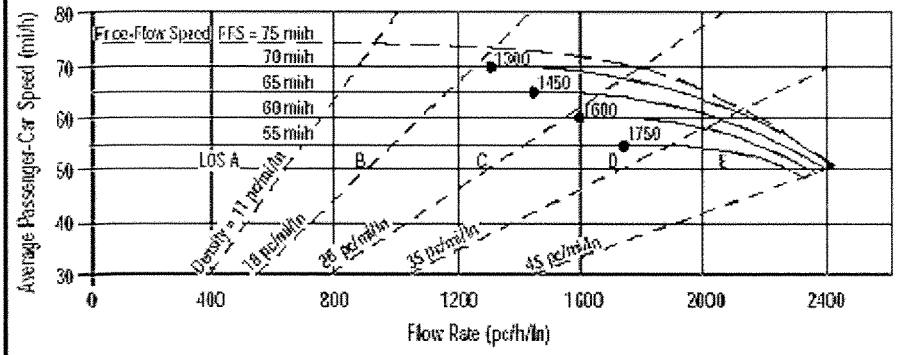
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 6 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1660*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*29.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 680 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2650	0.92	Level	2	0	0.990	1.00	2909
Ramp	360	0.92	Level	2	0	0.990	1.00	395
UpStream	680	0.92	Level	2	0	0.990	1.00	747
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 774.26 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1749 pc/h
V_3 or V_{av34} 1160 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3304	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2144	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 16.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.286 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 53.6 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 650 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.92	Level	2	0	0.990	1.00	3293
Ramp	770	0.82	Level	2	0	0.990	1.00	948
UpStream								
DownStream	650	0.92	Level	2	0	0.990	1.00	714

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.634 using Equation (Exhibit 25-12)
V_{12} = 2435 pc/h
V_3 or V_{av34} 858 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3293	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2345	Exhibit 25-14	6780	No
V_R	948	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2435	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 22.0 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.448 (Exhibit 25-19)
S_R= 49.7 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 470 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2250	0.92	Level	2	0	0.990	1.00	2470
Ramp	650	0.92	Level	2	0	0.990	1.00	714
UpStream								
DownStream	470	0.96	Level	2	0	0.990	1.00	494

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2399.22 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1489 pc/h
V_3 or V_{av34} 981 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3184	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2203	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 16.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.284 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 54.3 mph (Exhibit 25-19)
S = 52.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 650 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2750	0.92	Level	2	0	0.990	1.00	3019
Ramp	470	0.96	Level	2	0	0.990	1.00	494
UpStream	650	0.92	Level	2	0	0.990	1.00	714
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R = mph (Exhibit 25-19)

S_0 = mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 6939.25 (Equation 25-8 or 25-9)

P_{FD} = 0.722 using Equation (Exhibit 25-12)

V_{12} = 2318 pc/h

V_3 or V_{av34} 701 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3019	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2525	Exhibit 25-14	6780	No
V_R	494	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2318	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 21.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.472 (Exhibit 25-19)

S_R = 49.4 mph (Exhibit 25-19)

S_0 = 61.4 mph (Exhibit 25-19)

S = 51.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 360 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5250	0.92	Level	2	0	0.990	1.00	5764
Ramp	770	0.92	Level	2	0	0.990	1.00	845
UpStream								
DownStream	360	0.92	Level	2	0	0.990	1.00	395

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.577 using Equation (Exhibit 25-12)
V_{12} = 3683 pc/h
V_3 or V_{av34} 2081 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5764	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4919	Exhibit 25-14	6780	No
V_R	845	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3683	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.2 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.439 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 57.2 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 370 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5400	0.92	Level	2	0	0.990	1.00	5928
Ramp	1010	0.92	Level	2	0	0.990	1.00	1109
UpStream								
DownStream	370	0.93	Level	3	0	0.985	1.00	404

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.561 using Equation (Exhibit 25-12)
V_{12} = 3811 pc/h
V_3 or V_{av34} 2117 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5928	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4819	Exhibit 25-14	6780	No
V_R	1109	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3811	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 32.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.463 (Exhibit 25-19)
S_R= 49.5 mph (Exhibit 25-19)
S_0= 57.1 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 370 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4750	0.92	Level	2	0	0.990	1.00	5215
Ramp	510	0.93	Level	5	0	0.976	1.00	562
UpStream	370	0.93	Level	3	0	0.985	1.00	404
DownStream								

Merge Areas | Diverge Areas

Estimation of v_{12} (Merge Areas)

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.603 using Equation (Exhibit 25-5)

V_{12} = 3143 pc/h

V_3 or V_{av34} 2072 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} (Diverge Areas)

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks (Merge Areas)

	Actual	Capacity		LOS F?
V_{FO}	5777	Exhibit 25-7		No

Capacity Checks (Diverge Areas)

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3705	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) (Merge Areas)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 28.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F) (Diverge Areas)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination (Merge Areas)

M_S = 0.408 (Exibit 25-19)

S_R= 50.3 mph (Exhibit 25-19)

S_0= 50.3 mph (Exhibit 25-19)

S = 50.3 mph (Exhibit 25-14)

Speed Determination (Diverge Areas)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 510 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4450	0.92	Level	2	0	0.990	1.00	4885
Ramp	370	0.93	Level	3	0	0.985	1.00	404
UpStream								
DownStream	510	0.93	Level	5	0	0.976	1.00	562

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 2944 pc/h
V_3 or V_{av34} 1941 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5289	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3348	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 25.8 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.360 (Exibit 25-19)
S_R= 51.0 mph (Exhibit 25-19)
S_0= 50.8 mph (Exhibit 25-19)
S = 50.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2026 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.29
Weaving seg length, L (ft)	815	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2350	0.92	2	0	1.5	1.2	0.990	1.00	2579
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	680	0.92	2	0	1.5	1.2	0.990	1.00	746
V_{w2}	300	0.92	2	0	1.5	1.2	0.990	1.00	329
V_w				1075	V_{nw}				2579
V									3654

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.15	0.26
Weaving and non-weaving speeds, Si (mi/h)			29.58	51.51

Number of lanes required for unconstrained operation, Nw 1.42
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.29
Weaving segment density, D (pc/mi/ln)	21.60
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6221
Capacity as a 15-minute flow rate, c (veh/h)	6159
Capacity as a full-hour volume, c_h (veh/h)	5666

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2026 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	810	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3750	0.92	2	0	1.5	1.2	0.990	1.00	4116
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	750	0.92	2	0	1.5	1.2	0.990	1.00	823
V_{w2}	360	0.92	2	0	1.5	1.2	0.990	1.00	395
V_w				1218	V_{nw}				4116
V									5334

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.19	0.61		
Weaving and non-weaving speeds, Si (mi/h)	35.97	43.64		

Number of lanes required for unconstrained operation, Nw 1.27
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.61
Weaving segment density, D (pc/mi/ln)	32.04
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6578
Capacity as a 15-minute flow rate, c (veh/h)	6513
Capacity as a full-hour volume, c_h (veh/h)	5992

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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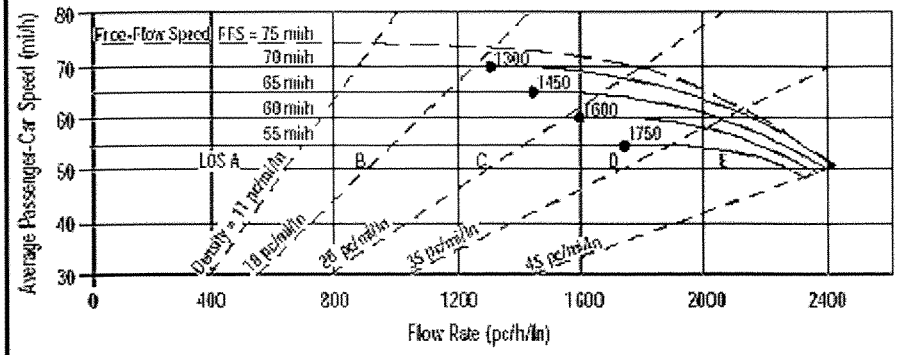
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 2 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1098*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*19.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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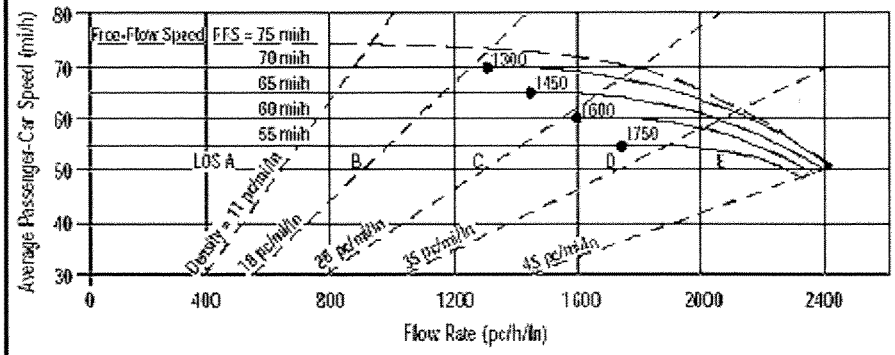
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5300*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1939*	pc/h/ln
S	*55.4*	mi/h
D = v_p / S	*35.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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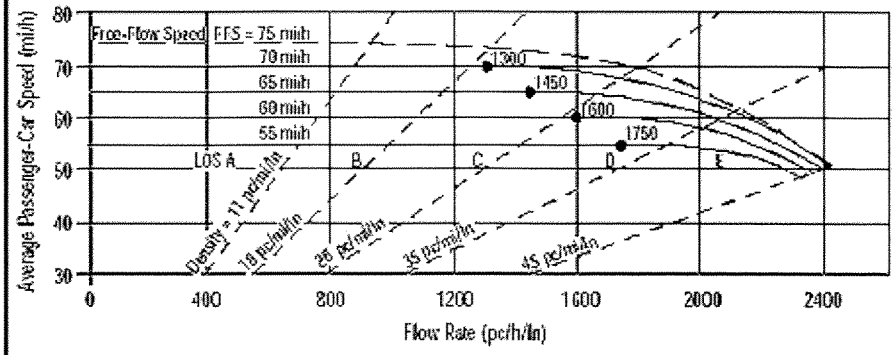
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/09/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*805*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*14.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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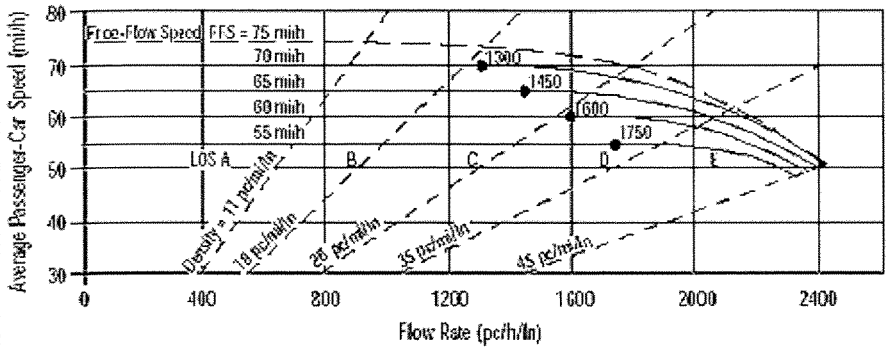
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*12/09/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 on to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1757*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*31.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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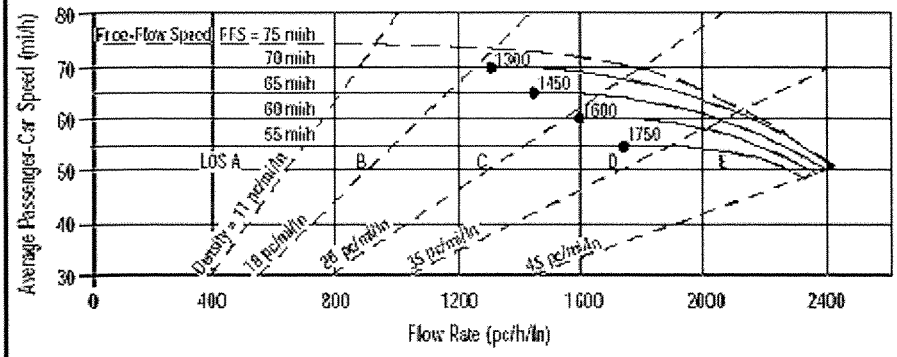
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1025*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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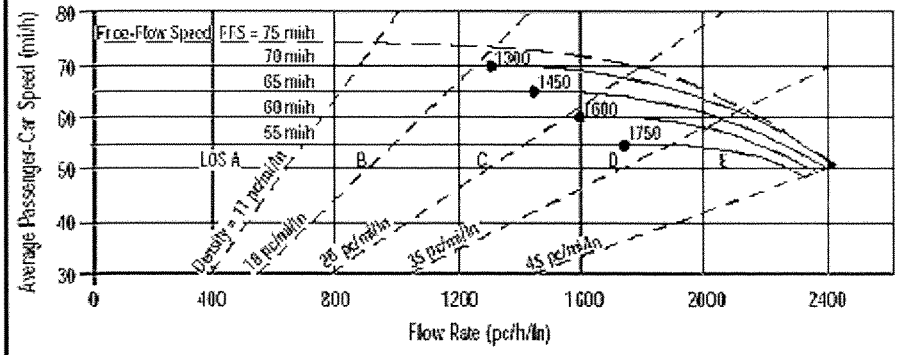
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1665*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*29.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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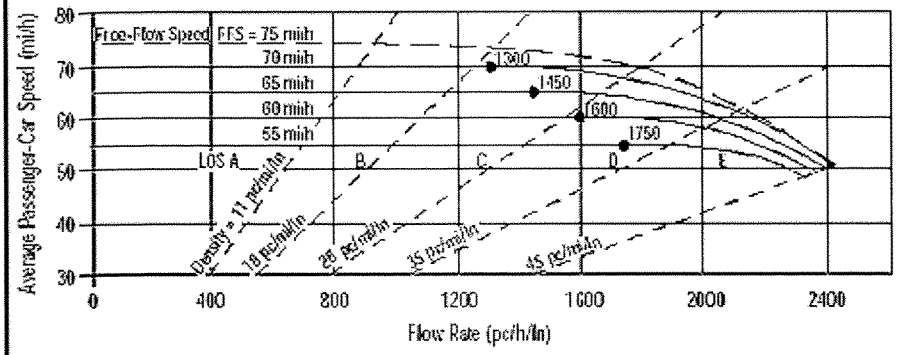

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*714*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*12.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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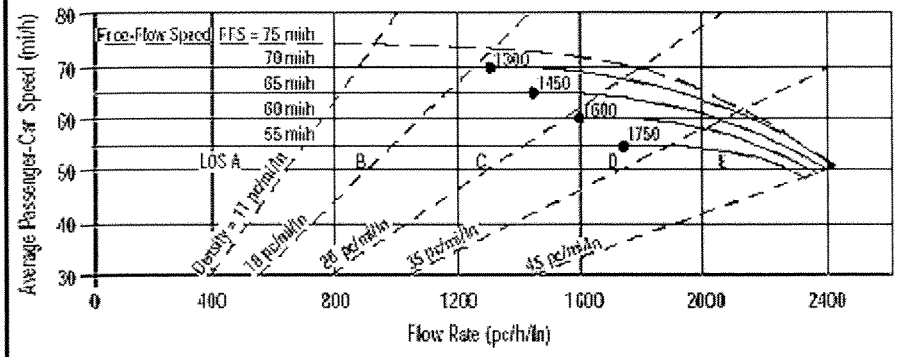
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 6 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1660*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*29.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 700 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2600	0.92	Level	2	0	0.990	1.00	2854
Ramp	380	0.92	Level	2	0	0.990	1.00	417
UpStream	700	0.92	Level	2	0	0.990	1.00	768
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 767.19 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1716 pc/h
V_3 or V_{av34} 1138 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3271	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2133	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 16.6 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.286 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 53.7 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 640 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.92	Level	2	0	0.990	1.00	3293
Ramp	800	0.82	Level	2	0	0.990	1.00	985
UpStream								
DownStream	640	0.92	Level	2	0	0.990	1.00	703

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.632 using Equation (Exhibit 25-12)
V_{12} = 2444 pc/h
V_3 or V_{av34} 849 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3293	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2308	Exhibit 25-14	6780	No
V_R	985	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2444	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 22.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.452 (Exhibit 25-19)
S_R= 49.7 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 480 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2200	0.92	Level	2	0	0.990	1.00	2415
Ramp	640	0.92	Level	2	0	0.990	1.00	703
UpStream								
DownStream	480	0.96	Level	2	0	0.990	1.00	505

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 2452.65 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1456 pc/h
V_3 or V_{av34} 959 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3118	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2159	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$
D_R = 16.3 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.283 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 54.3 mph (Exhibit 25-19)
S = 52.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 640 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2800	0.92	Level	2	0	0.990	1.00	3074
Ramp	480	0.96	Level	2	0	0.990	1.00	505
UpStream	640	0.92	Level	2	0	0.990	1.00	703
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 6803.97 (Equation 25-8 or 25-9)
P_{FD} = 0.718 using Equation (Exhibit 25-12)
V_{12} = 2351 pc/h
V_3 or V_{av34} 723 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3074	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2569	Exhibit 25-14	6780	No
V_R	505	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2351	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 22.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.473 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 51.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 360 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5300	0.92	Level	2	0	0.990	1.00	5818
Ramp	760	0.92	Level	2	0	0.990	1.00	834
UpStream								
DownStream	360	0.92	Level	2	0	0.990	1.00	395

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.576 using Equation (Exhibit 25-12)
V_{12} = 3706 pc/h
V_3 or V_{av34} 2112 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5818	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4984	Exhibit 25-14	6780	No
V_R	834	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3706	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.438 (Exhibit 25-19)
S_R= 49.9 mph (Exhibit 25-19)
S_0= 57.1 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 400 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5400	0.92	Level	2	0	0.990	1.00	5928
Ramp	1020	0.92	Level	2	0	0.990	1.00	1120
UpStream								
DownStream	400	0.93	Level	3	0	0.985	1.00	437

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.560 using Equation (Exhibit 25-12)
V_{12} = 3814 pc/h
V_3 or V_{av34} 2114 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5928	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4808	Exhibit 25-14	6780	No
V_R	1120	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3814	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 32.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.464 (Exhibit 25-19)
S_R = 49.5 mph (Exhibit 25-19)
S_0 = 57.1 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 400 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4800	0.92	Level	2	0	0.990	1.00	5270
Ramp	490	0.93	Level	5	0	0.976	1.00	540
UpStream	400	0.93	Level	3	0	0.985	1.00	437
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3176 pc/h
V_3 or V_{av34} 2094 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5810	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3716	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 28.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.409 (Exibit 25-19)
S_R= 50.3 mph (Exhibit 25-19)
S_0= 50.3 mph (Exhibit 25-19)
S = 50.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 490 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4550	0.92	Level	2	0	0.990	1.00	4995
Ramp	400	0.93	Level	3	0	0.985	1.00	437
UpStream								
DownStream	490	0.93	Level	5	0	0.976	1.00	540

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3010 pc/h
V_3 or V_{av34} 1985 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	5432	Exhibit 25-7		No

Capacity Checks — Diverge Areas

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3447	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 26.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = 0.371 (Exibit 25-19)
S_R= 50.8 mph (Exhibit 25-19)
S_0= 50.7 mph (Exhibit 25-19)
S = 50.7 mph (Exhibit 25-14)

Speed Determination — Diverge Areas

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2036 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.31
Weaving seg length, L (ft)	815	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2290	0.92	2	0	1.5	1.2	0.990	1.00	2514
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	700	0.92	2	0	1.5	1.2	0.990	1.00	768
V_{w2}	310	0.92	2	0	1.5	1.2	0.990	1.00	340
V_w				1108	V_{nw}				2514
V									3622

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)			0.35	0.0020
b (Exhibit 24-6)			2.20	4.00
c (Exhibit 24-6)			0.97	1.30
d (Exhibit 24-6)			0.80	0.75
Weaving intensity factor, Wi			2.18	0.27
Weaving and non-weaving speeds, Si (mi/h)			29.47	51.33

Number of lanes required for unconstrained operation, Nw 1.46
Maximum number of lanes, Nw (max) 1.40

☐ If Nw < Nw(max) unconstrained operation ☑ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.83
Weaving segment density, D (pc/mi/ln)	21.64
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6154
Capacity as a 15-minute flow rate, c (veh/h)	6093
Capacity as a full-hour volume, c_h (veh/h)	5606

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2036 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.24
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3740	0.92	2	0	1.5	1.2	0.990	1.00	4105
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	810	0.92	2	0	1.5	1.2	0.990	1.00	889
V_{w2}	360	0.92	2	0	1.5	1.2	0.990	1.00	395
V_w				1284	V_{nw}				4105
V									5389

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.23	0.63		
Weaving and non-weaving speeds, Si (mi/h)	35.65	43.15		

Number of lanes required for unconstrained operation, Nw 1.31
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.09
Weaving segment density, D (pc/mi/ln)	32.79
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6524
Capacity as a 15-minute flow rate, c (veh/h)	6459
Capacity as a full-hour volume, c_h (veh/h)	5942

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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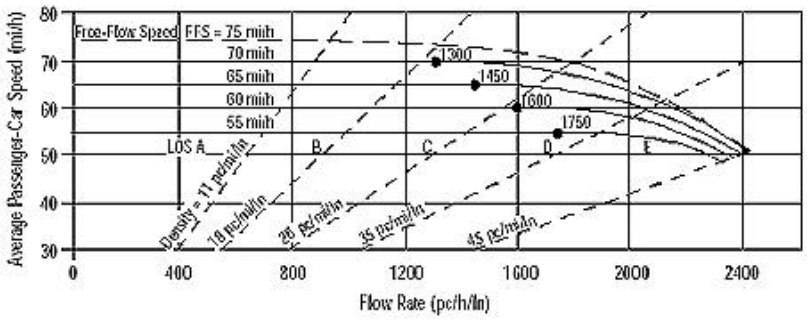
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*12/13/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*768*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*13.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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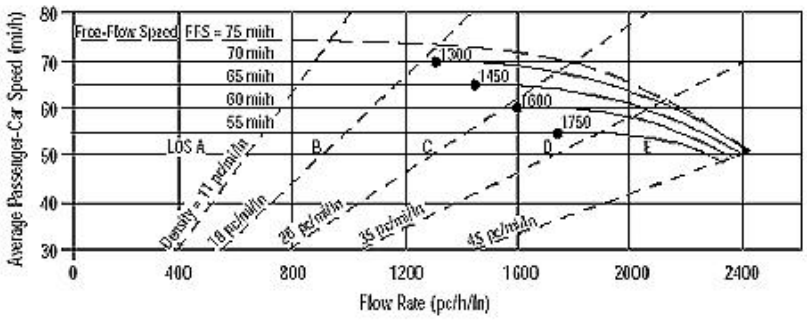

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 on to Exit 4 on*
Date Performed	*12/13/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1757*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*31.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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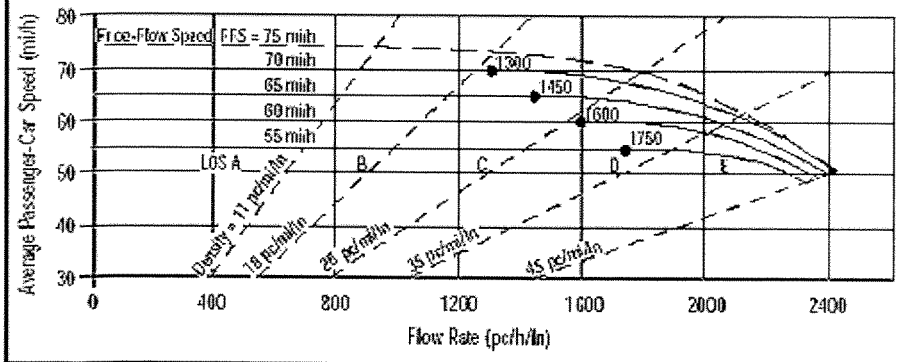
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 2 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5100*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1997*	pc/h/ln
S	*55.0*	mi/h
D = v_p / S	*36.3*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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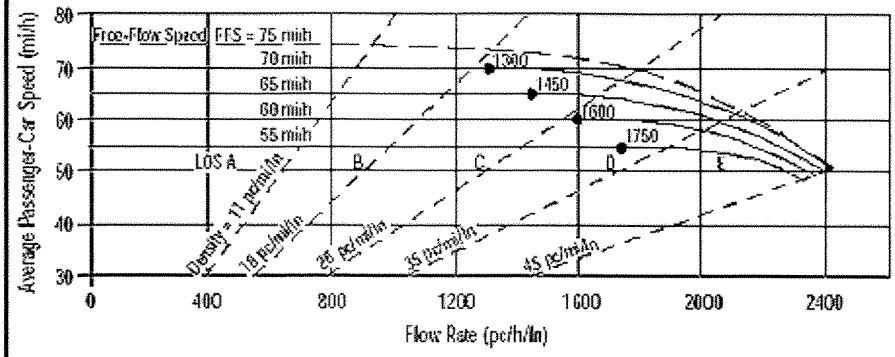
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1409*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*25.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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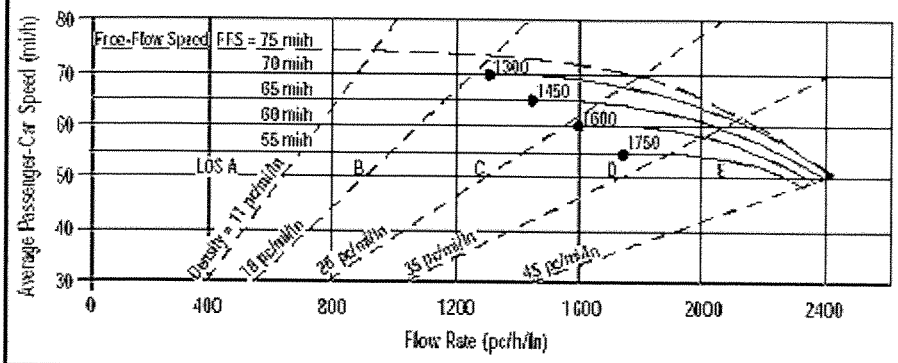
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1762*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*31.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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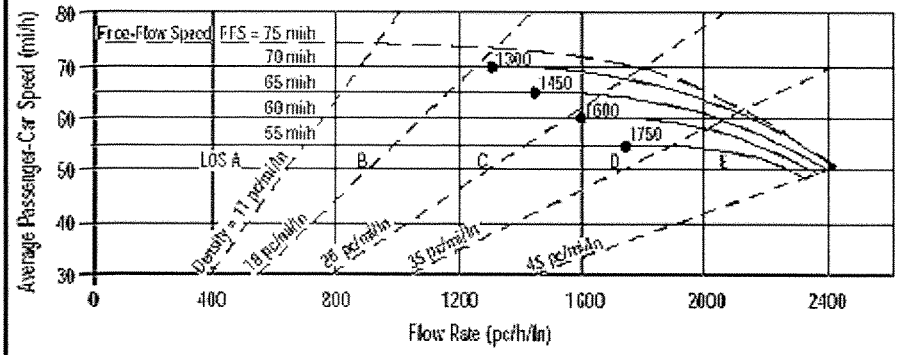
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*12/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 on to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1025*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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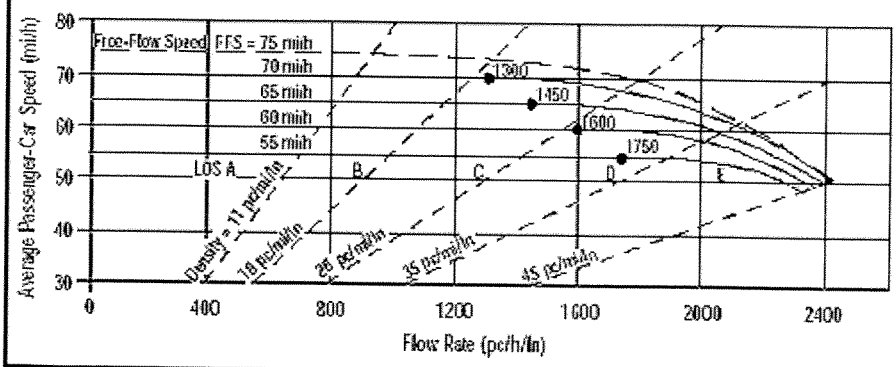
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5900*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2310*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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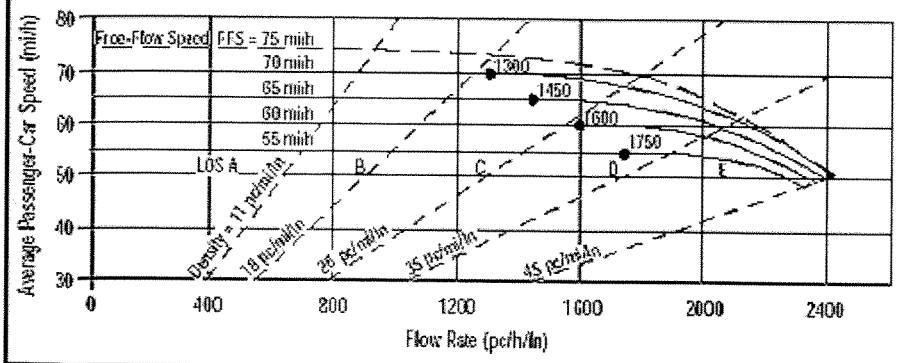
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*933*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*16.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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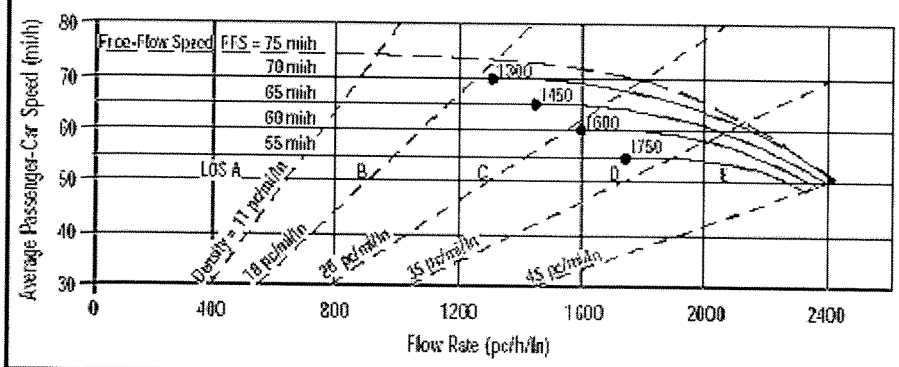
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6100*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1791*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*32.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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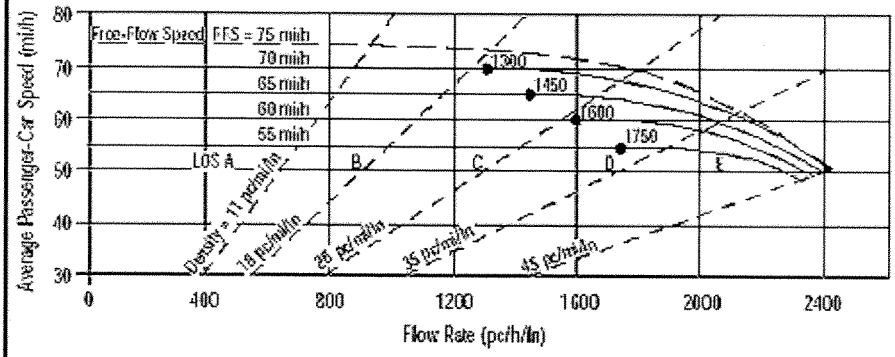
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 6 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2016 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*947*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*16.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 900 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.86	Level	2	0	0.990	1.00	5167
Ramp	730	0.92	Level	2	0	0.990	1.00	801
UpStream	900	0.92	Level	2	0	0.990	1.00	988
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1344.35 (Equation 25-2 or 25-3)
P_{FM} = 0.586 using Equation (Exhibit 25-5)
V_{12} = 3027 pc/h
V_3 or V_{av34} 2140 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5968	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3828	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 29.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.432 (Exibit 25-19)
S_R= 49.9 mph (Exhibit 25-19)
S_0= 50.1 mph (Exhibit 25-19)
S = 50.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 1430 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5100	0.86	Level	2	0	0.990	1.00	5990
Ramp	620	0.86	Level	2	0	0.990	1.00	728
UpStream								
DownStream	1430	0.88	Level	1	0	0.995	1.00	1633

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.577 using Equation (Exhibit 25-12)
V_{12} = 3763 pc/h
V_3 or V_{av34} 2227 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5990	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5262	Exhibit 25-14	6780	No
V_R	728	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3763	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.5 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.429 (Exhibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 56.6 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 440 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4500	0.86	Level	2	0	0.990	1.00	5285
Ramp	1430	0.88	Level	1	0	0.995	1.00	1633
UpStream								
DownStream	440	0.92	Level	3	0	0.985	1.00	485

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2355.51 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3185 pc/h
V_3 or V_{av34} 2100 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6918	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4818	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 36.7 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.731 (Exibit 25-19)
S_R= 45.8 mph (Exhibit 25-19)
S_0= 50.2 mph (Exhibit 25-19)
S = 47.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 1430 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5900	0.86	Level	2	0	0.990	1.00	6929
Ramp	440	0.92	Level	3	0	0.985	1.00	485
UpStream	1430	0.88	Level	1	0	0.995	1.00	1633
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 8438.97 (Equation 25-8 or 25-9)
P_{FD} = 0.729 using Equation (Exhibit 25-12)
V_{12} = 5180 pc/h
V_3 or V_{av34} 1749 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6929	Exhibit 25-14	6780	Yes
$V_{FO} = V_F - V_R$	6444	Exhibit 25-14	6780	No
V_R	485	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5180	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 46.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.472 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 58.5 mph (Exhibit 25-19)
S = 51.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 800 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3850	0.92	Level	2	0	0.990	1.00	4227
Ramp	500	0.92	Level	2	0	0.990	1.00	549
UpStream								
DownStream	800	0.92	Level	2	0	0.990	1.00	878

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.629 using Equation (Exhibit 25-12)
V_{12} = 2863 pc/h
V_3 or V_{av34} 1364 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4227	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3678	Exhibit 25-14	6780	No
V_R	549	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2863	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 26.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.412 (Exhibit 25-19)
S_R = 50.2 mph (Exhibit 25-19)
S_0 = 60.0 mph (Exhibit 25-19)
S = 53.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 440 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2800	0.92	Level	2	0	0.990	1.00	3074
Ramp	640	0.92	Level	2	0	0.990	1.00	703
UpStream								
DownStream	440	0.87	Level	1	0	0.995	1.00	508

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.651 using Equation (Exhibit 25-12)
V_{12} = 2246 pc/h
V_3 or V_{av34} 828 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3074	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2371	Exhibit 25-14	6780	No
V_R	703	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2246	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 19.3 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.426 (Exhibit 25-19)
S_R = 50.0 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 52.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 440 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2800	0.92	Level	2	0	0.990	1.00	3074
Ramp	1050	0.93	Level	4	0	0.980	1.00	1152
UpStream	440	0.87	Level	1	0	0.995	1.00	508
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1853 pc/h
V_3 or V_{av34} 1221 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4226	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3005	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 22.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.328 (Exibit 25-19)
S_R= 51.4 mph (Exhibit 25-19)
S_0= 53.4 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 1050 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2550	0.92	Level	2	0	0.990	1.00	2799
Ramp	440	0.87	Level	1	0	0.995	1.00	508
UpStream								
DownStream	1050	0.93	Level	4	0	0.980	1.00	1152

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1687 pc/h
V_3 or V_{av34} 1112 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3307	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2195	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 16.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.284 (Exibit 25-19)
S_R = 52.0 mph (Exhibit 25-19)
S_0 = 53.8 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2016 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.25
Weaving seg length, L (ft)	815	Weaving ratio, R	0.34
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3930	0.86	2	0	1.5	1.2	0.990	1.00	4615
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	900	0.92	2	0	1.5	1.2	0.990	1.00	988
V_{w2}	470	0.92	2	0	1.5	1.2	0.990	1.00	515
V_w				1503	V_{nw}				4615
V									6118

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.40	0.76		
Weaving and non-weaving speeds, Si (mi/h)	34.17	41.10		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.15
Weaving segment density, D (pc/mi/ln)	39.07
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6490
Capacity as a 15-minute flow rate, c (veh/h)	6426
Capacity as a full-hour volume, c_h (veh/h)	5626

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	6/22/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2016 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.26
Weaving seg length, L (ft)	810	Weaving ratio, R	0.25
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3080	0.92	2	0	1.5	1.2	0.990	1.00	3381
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	800	0.92	2	0	1.5	1.2	0.990	1.00	878
V_{w2}	270	0.92	2	0	1.5	1.2	0.990	1.00	296
V_w				1174	V_{nw}				3381
V									4555

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.08	0.54		
Weaving and non-weaving speeds, Si (mi/h)	37.12	44.82		

Number of lanes required for unconstrained operation, Nw 1.34
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.55
Weaving segment density, D (pc/mi/ln)	26.76
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6416
Capacity as a 15-minute flow rate, c (veh/h)	6352
Capacity as a full-hour volume, c_h (veh/h)	5844

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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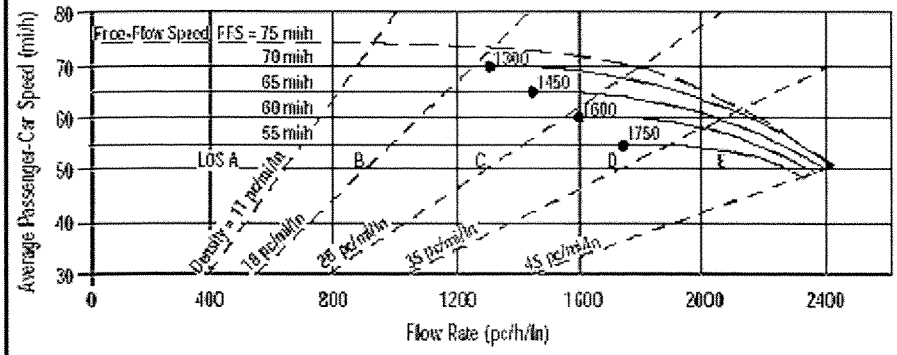
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5150*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	l/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2016*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*54.8*	mi/h	S	mi/h
D = v_p / S	*36.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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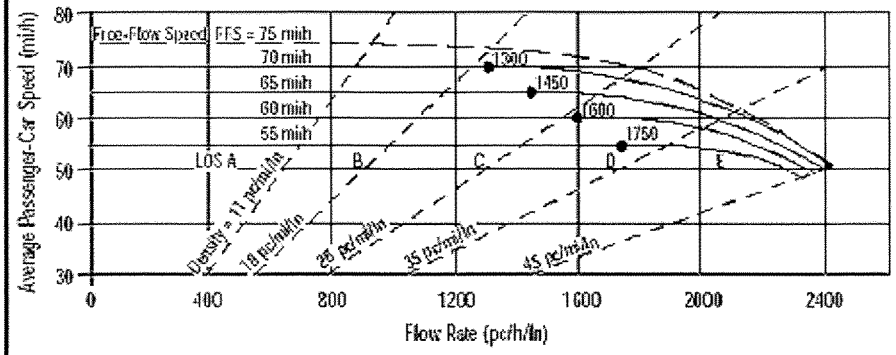

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3950*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1445*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*25.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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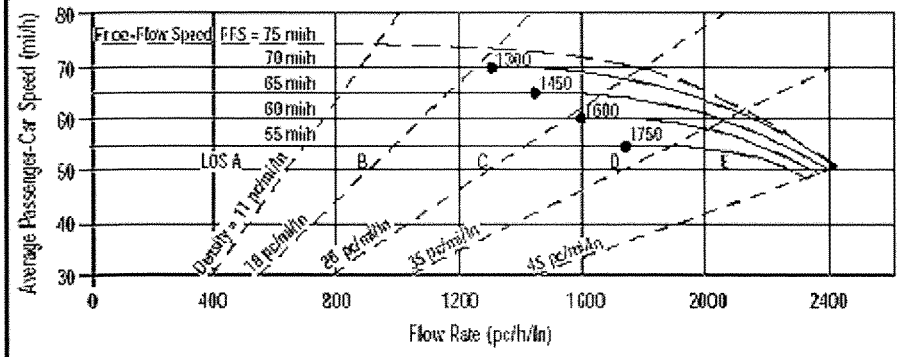
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1762*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*31.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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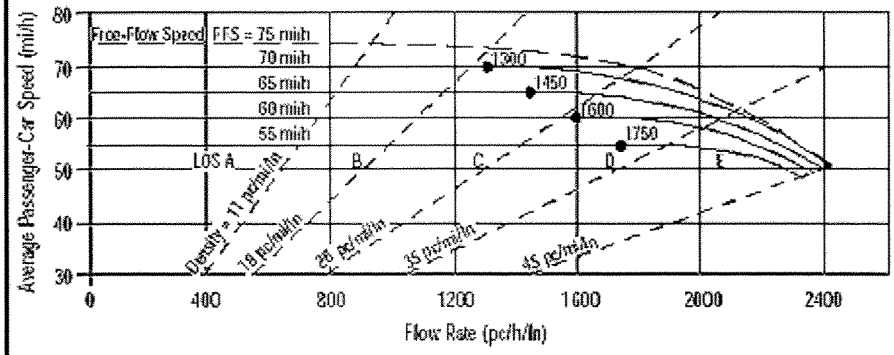
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 on to Exit 4 on*
Date Performed	*12/09/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1043*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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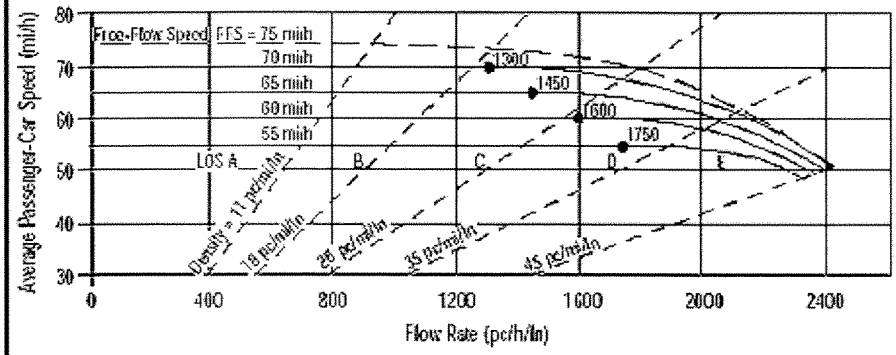
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5950*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2329*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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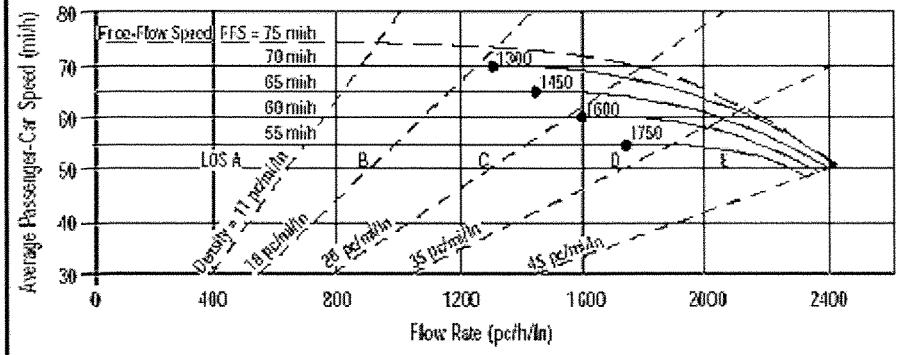
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	l/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*951*	pc/h/ln	Design LOS		
S	*56.0*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	*17.0*	pc/mi/ln	S		mi/h
LOS	*B*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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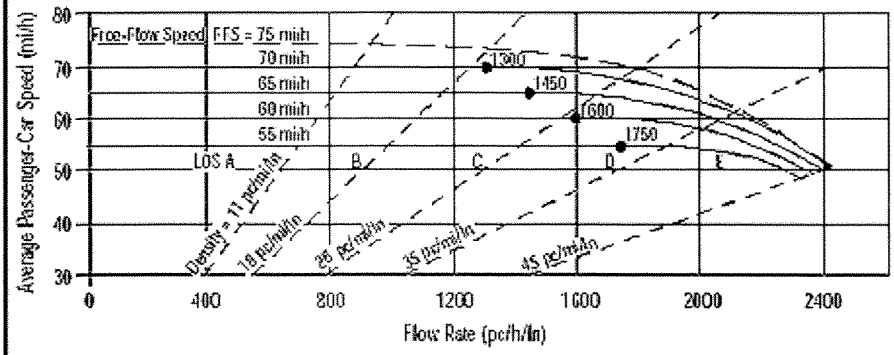
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6150*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1806*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*32.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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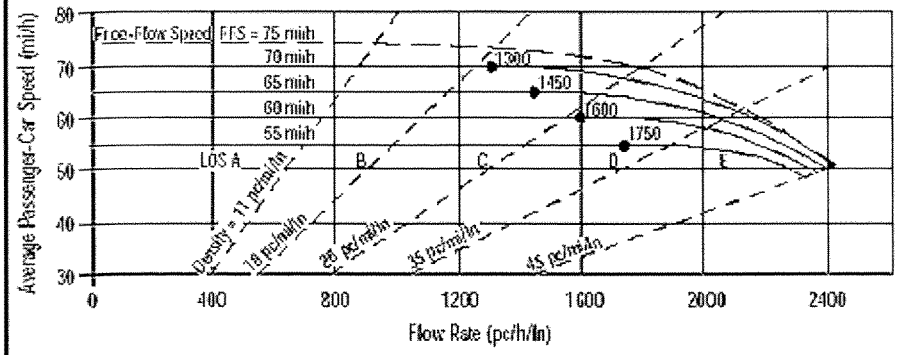
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1002*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*17.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)		
Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 880 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.86	Level	2	0	0.990	1.00	5167
Ramp	730	0.92	Level	2	0	0.990	1.00	801
UpStream	880	0.92	Level	2	0	0.990	1.00	966
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1344.35 (Equation 25-2 or 25-3)
P_{FM} = 0.586 using Equation (Exhibit 25-5)
V_{12} = 3027 pc/h
V_3 or V_{av34} 2140 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5968	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3828	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 29.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.432 (Exibit 25-19)
S_R= 49.9 mph (Exhibit 25-19)
S_0= 50.1 mph (Exhibit 25-19)
S = 50.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 1470 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5150	0.86	Level	2	0	0.990	1.00	6048
Ramp	630	0.86	Level	2	0	0.990	1.00	740
UpStream								
DownStream	1470	0.88	Level	1	0	0.995	1.00	1679

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.575 using Equation (Exhibit 25-12)
V_{12} = 3791 pc/h
V_3 or V_{av34} 2257 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6048	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5308	Exhibit 25-14	6780	No
V_R	740	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3791	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.430 (Exhibit 25-19)
S_R = 50.0 mph (Exhibit 25-19)
S_0 = 56.5 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 450 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4500	0.86	Level	2	0	0.990	1.00	5285
Ramp	1470	0.88	Level	1	0	0.995	1.00	1679
UpStream								
DownStream	450	0.92	Level	3	0	0.985	1.00	496

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2408.94 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3185 pc/h
V_3 or V_{av34} 2100 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6964	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4864	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 37.0 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.754 (Exibit 25-19)
S_R= 45.4 mph (Exhibit 25-19)
S_0= 50.2 mph (Exhibit 25-19)
S = 46.8 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 1470 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5950	0.86	Level	2	0	0.990	1.00	6988
Ramp	450	0.92	Level	3	0	0.985	1.00	496
UpStream	1470	0.88	Level	1	0	0.995	1.00	1679
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 8653.39 (Equation 25-8 or 25-9)
P_{FD} = 0.734 using Equation (Exhibit 25-12)
V_{12} = 5263 pc/h
V_3 or V_{av34} 1725 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6988	Exhibit 25-14	6780	Yes
$V_{FO} = V_F - V_R$	6492	Exhibit 25-14	6780	No
V_R	496	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5263	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 47.3 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.473 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 58.6 mph (Exhibit 25-19)
S = 51.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 56.0 mph S_{FR} = 40.0 mph	L_{down} = 1300 ft
V_u = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	V_D = 850 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3950	0.92	Level	2	0	0.990	1.00	4336
Ramp	570	0.92	Level	2	0	0.990	1.00	626
UpStream								
DownStream	850	0.92	Level	2	0	0.990	1.00	933

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.623 using Equation (Exhibit 25-12)

V_{12} = 2937 pc/h

V_3 or V_{av34} 1399 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4336	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3710	Exhibit 25-14	6780	No
V_R	626	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2937	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.8 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.419 (Exhibit 25-19)

S_R= 50.1 mph (Exhibit 25-19)

S_0= 59.9 mph (Exhibit 25-19)

S = 52.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 450 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.92	Level	2	0	0.990	1.00	3293
Ramp	620	0.92	Level	2	0	0.990	1.00	681
UpStream								
DownStream	450	0.87	Level	1	0	0.995	1.00	520

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.646 using Equation (Exhibit 25-12)
V_{12} = 2369 pc/h
V_3 or V_{av34} 924 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3293	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2612	Exhibit 25-14	6780	No
V_R	681	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2369	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 20.4 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.424 (Exhibit 25-19)
S_R= 50.1 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 450 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2850	0.92	Level	2	0	0.990	1.00	3129
Ramp	1110	0.93	Level	4	0	0.980	1.00	1217
UpStream	450	0.87	Level	1	0	0.995	1.00	520
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.603 using Equation (Exhibit 25-5)

V_{12} = 1886 pc/h

V_3 or V_{av34} 1243 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4346	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3103	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.336 (Exibit 25-19)

S_R= 51.3 mph (Exhibit 25-19)

S_0= 53.3 mph (Exhibit 25-19)

S = 51.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 1110 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2600	0.92	Level	2	0	0.990	1.00	2854
Ramp	450	0.87	Level	1	0	0.995	1.00	520
UpStream								
DownStream	1110	0.93	Level	4	0	0.980	1.00	1217

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1720 pc/h
V_3 or V_{av34} 1134 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3374	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2240	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 17.1 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.286 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 53.7 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2026 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.24
Weaving seg length, L (ft)	815	Weaving ratio, R	0.35
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3930	0.86	2	0	1.5	1.2	0.990	1.00	4615
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	880	0.92	2	0	1.5	1.2	0.990	1.00	966
V_{w2}	470	0.92	2	0	1.5	1.2	0.990	1.00	515
V_w				1481	V_{nw}				4615
V									6096

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.39	0.75		
Weaving and non-weaving speeds, Si (mi/h)	34.26	41.25		

Number of lanes required for unconstrained operation, Nw 1.35
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.30
Weaving segment density, D (pc/mi/ln)	38.78
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6505
Capacity as a 15-minute flow rate, c (veh/h)	6441
Capacity as a full-hour volume, c_h (veh/h)	5638

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	6/22/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2026 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.26
Weaving seg length, L (ft)	810	Weaving ratio, R	0.23
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3150	0.92	2	0	1.5	1.2	0.990	1.00	3458
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	850	0.92	2	0	1.5	1.2	0.990	1.00	933
V_{w2}	250	0.92	2	0	1.5	1.2	0.990	1.00	274
V_w				1207	V_{nw}				3458
V									4665

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.11	0.56		
Weaving and non-weaving speeds, Si (mi/h)	36.84	44.46		

Number of lanes required for unconstrained operation, Nw 1.35
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.20
Weaving segment density, D (pc/mi/ln)	27.64
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6410
Capacity as a 15-minute flow rate, c (veh/h)	6347
Capacity as a full-hour volume, c_h (veh/h)	5839

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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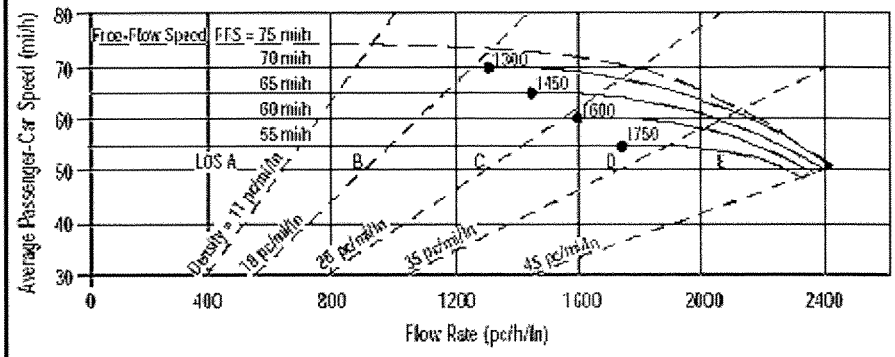
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 2 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5200*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2036*	pc/h/ln
S	*54.6*	mi/h
D = v_p / S	*37.3*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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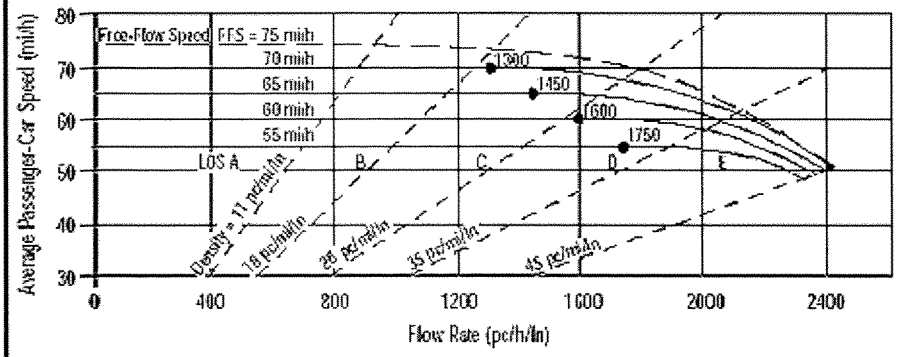
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 4 to Exit 2*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1500*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*26.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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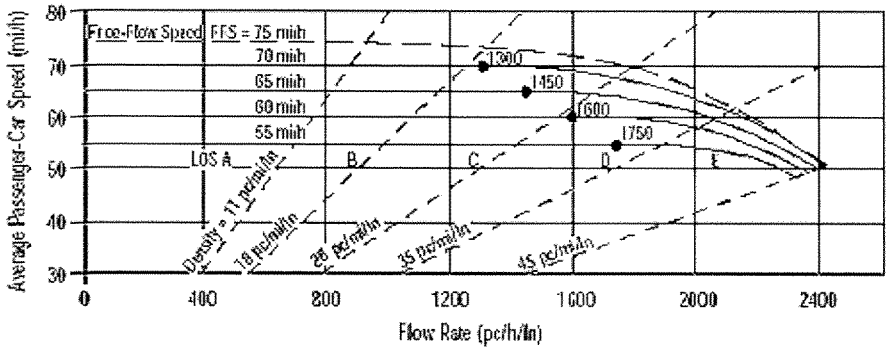

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*9/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 4 off to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4600*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1801*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*32.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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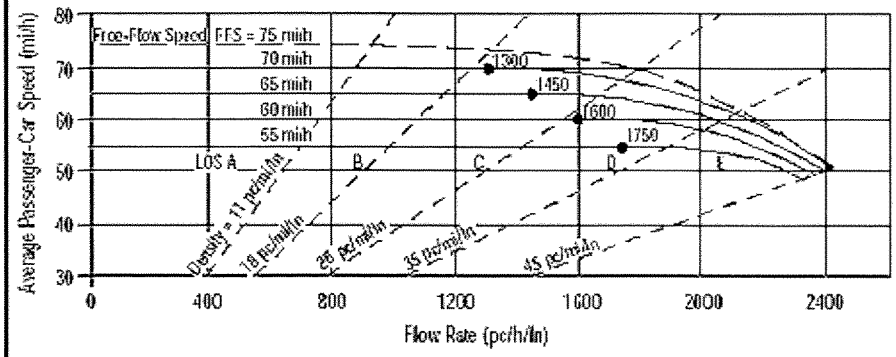

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*12/09/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 on to Exit 4 on*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2950*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1080*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*19.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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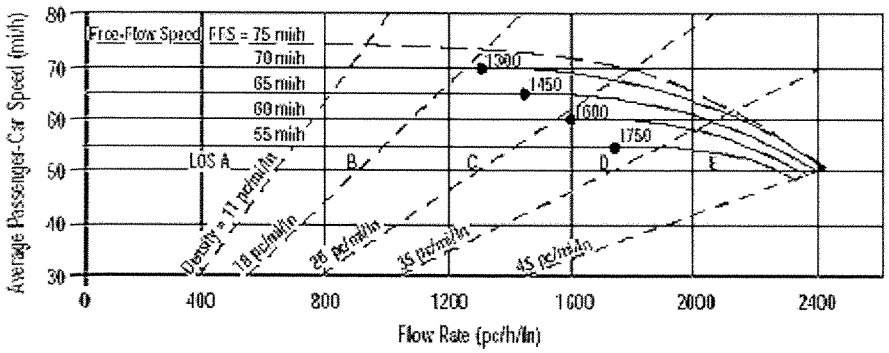

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*6/22/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6050*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2368*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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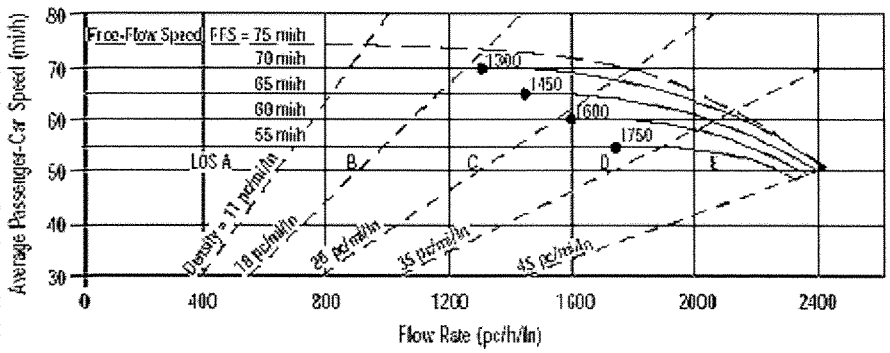

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 5 to Exit 4*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1006*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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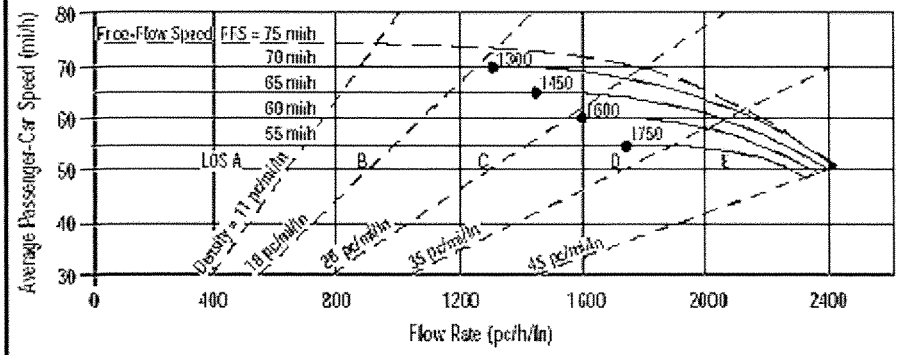

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Northbound I-87*
From/To	*Exit 5 to Exit 6*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6250*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1835*	pc/h/ln
S	*55.9*	mi/h
D = v_p / S	*32.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	mi/h
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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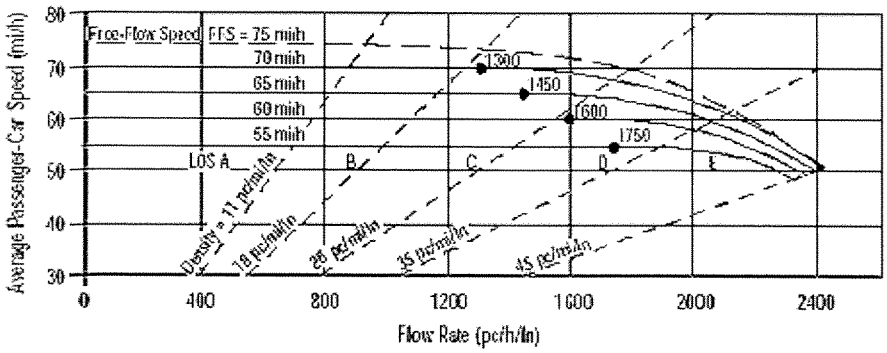

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*SEB*
Agency or Company	*CHA*
Date Performed	*6/22/2011*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*Southbound I-87*
From/To	*Exit 6 to Exit 5*
Jurisdiction	*NYSDOT*
Analysis Year	*2036 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	l/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1043*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*18.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 860 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4450	0.86	Level	2	0	0.990	1.00	5226
Ramp	740	0.92	Level	2	0	0.990	1.00	812
UpStream	860	0.92	Level	2	0	0.990	1.00	944
DownStream								

Merge Areas | Diverge Areas

Estimation of v_{12} (Merge Areas)

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1359.33 (Equation 25-2 or 25-3)
P_{FM} = 0.585 using Equation (Exhibit 25-5)
V_{12} = 3056 pc/h
V_3 or V_{av34} 2170 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} (Diverge Areas)

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks (Merge Areas)

	Actual	Capacity		LOS F?
V_{FO}	6038	Exhibit 25-7		No

Capacity Checks (Diverge Areas)

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3868	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) (Merge Areas)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 29.9 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F) (Diverge Areas)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination (Merge Areas)

M_S = 0.440 (Exibit 25-19)
S_R= 49.8 mph (Exhibit 25-19)
S_0= 50.0 mph (Exhibit 25-19)
S = 49.9 mph (Exhibit 25-14)

Speed Determination (Diverge Areas)

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2660 ft
V_D = 1500 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5200	0.86	Level	2	0	0.990	1.00	6107
Ramp	630	0.86	Level	2	0	0.990	1.00	740
UpStream								
DownStream	1500	0.88	Level	1	0	0.995	1.00	1713

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.573 using Equation (Exhibit 25-12)
V_{12} = 3817 pc/h
V_3 or V_{av34} 2290 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6107	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5367	Exhibit 25-14	6780	No
V_R	740	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3817	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.9 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.430 (Exhibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 56.4 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 3500 ft
V_D = 470 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4600	0.86	Level	2	0	0.990	1.00	5402
Ramp	1500	0.88	Level	1	0	0.995	1.00	1713
UpStream								
DownStream	470	0.92	Level	3	0	0.985	1.00	519

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2520.64 (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 3256 pc/h
V_3 or V_{av34} 2146 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7115	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4969	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 37.8 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.810 (Exibit 25-19)
S_R= 44.7 mph (Exhibit 25-19)
S_0= 50.1 mph (Exhibit 25-19)
S = 46.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 3500 ft
V_u = 1500 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6050	0.86	Level	2	0	0.990	1.00	7105
Ramp	470	0.92	Level	3	0	0.985	1.00	519
UpStream	1500	0.88	Level	1	0	0.995	1.00	1713
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 8785.92 (Equation 25-8 or 25-9)
P_{FD} = 0.736 using Equation (Exhibit 25-12)
V_{12} = 5363 pc/h
V_3 or V_{av34} 1742 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7105	Exhibit 25-14	6780	Yes
$V_{FO} = V_F - V_R$	6586	Exhibit 25-14	6780	No
V_R	519	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5363	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 48.1 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.475 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 58.5 mph (Exhibit 25-19)
S = 51.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 910 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4100	0.92	Level	2	0	0.990	1.00	4501
Ramp	650	0.92	Level	2	0	0.990	1.00	714
UpStream								
DownStream	910	0.92	Level	2	0	0.990	1.00	999

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.615 using Equation (Exhibit 25-12)
V_{12} = 3042 pc/h
V_3 or V_{av34} 1459 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4501	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3787	Exhibit 25-14	6780	No
V_R	714	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3042	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 27.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.427 (Exhibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 59.6 mph (Exhibit 25-19)
S = 52.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3100 ft
V_D = 470 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3100	0.92	Level	2	0	0.990	1.00	3403
Ramp	600	0.92	Level	2	0	0.990	1.00	659
UpStream								
DownStream	470	0.87	Level	1	0	0.995	1.00	543

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.645 using Equation (Exhibit 25-12)
V_{12} = 2428 pc/h
V_3 or V_{av34} 975 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3403	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2744	Exhibit 25-14	6780	No
V_R	659	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2428	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 20.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.422 (Exhibit 25-19)
S_R = 50.1 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 52.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 2035 ft
V_u = 470 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2950	0.92	Level	2	0	0.990	1.00	3239
Ramp	1170	0.93	Level	4	0	0.980	1.00	1283
UpStream	470	0.87	Level	1	0	0.995	1.00	543
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1952 pc/h
V_3 or V_{av34} 1287 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4522	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3235	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 24.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.348 (Exibit 25-19)
S_R= 51.1 mph (Exhibit 25-19)
S_0= 53.2 mph (Exhibit 25-19)
S = 51.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	9/08/2011	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 No-Build

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2035 ft
V_D = 1170 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2750	0.92	Level	2	0	0.990	1.00	3019
Ramp	470	0.87	Level	1	0	0.995	1.00	543
UpStream								
DownStream	1170	0.93	Level	4	0	0.980	1.00	1283

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.603 using Equation (Exhibit 25-5)
V_{12} = 1820 pc/h
V_3 or V_{av34} 1199 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3562	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2363	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 18.0 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.290 (Exibit 25-19)
S_R= 51.9 mph (Exhibit 25-19)
S_0= 53.5 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	9/08/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2036 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.24
Weaving seg length, L (ft)	815	Weaving ratio, R	0.35
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3980	0.86	2	0	1.5	1.2	0.990	1.00	4674
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	860	0.92	2	0	1.5	1.2	0.990	1.00	944
V_{w2}	470	0.92	2	0	1.5	1.2	0.990	1.00	515
V_w				1459	V_{nw}				4674
V									6133

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.38	0.75		
Weaving and non-weaving speeds, Si (mi/h)	34.30	41.35		

Number of lanes required for unconstrained operation, Nw 1.33
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.42
Weaving segment density, D (pc/mi/ln)	38.90
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6533
Capacity as a 15-minute flow rate, c (veh/h)	6468
Capacity as a full-hour volume, c_h (veh/h)	5660

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	6/22/2011
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2036 No-Build

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.26
Weaving seg length, L (ft)	810	Weaving ratio, R	0.20
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3220	0.92	2	0	1.5	1.2	0.990	1.00	3534
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	910	0.92	2	0	1.5	1.2	0.990	1.00	999
V_{w2}	230	0.92	2	0	1.5	1.2	0.990	1.00	252
V_w				1251	V_{nw}				3534
V									4785

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.14	0.59		
Weaving and non-weaving speeds, Si (mi/h)	36.50	44.02		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.77
Weaving segment density, D (pc/mi/ln)	28.64
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6395
Capacity as a 15-minute flow rate, c (veh/h)	6332
Capacity as a full-hour volume, c_h (veh/h)	5825

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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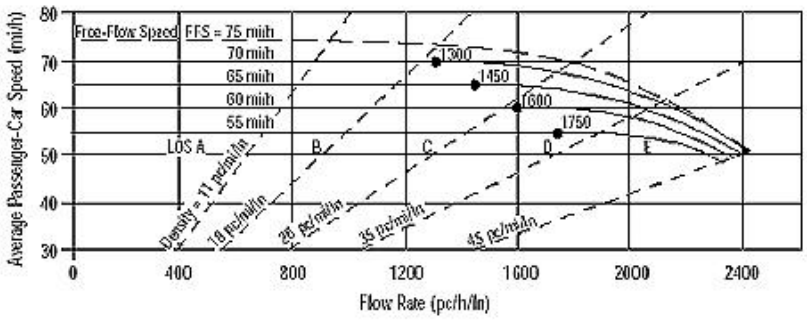
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*12/13/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4550*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1781*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*31.8*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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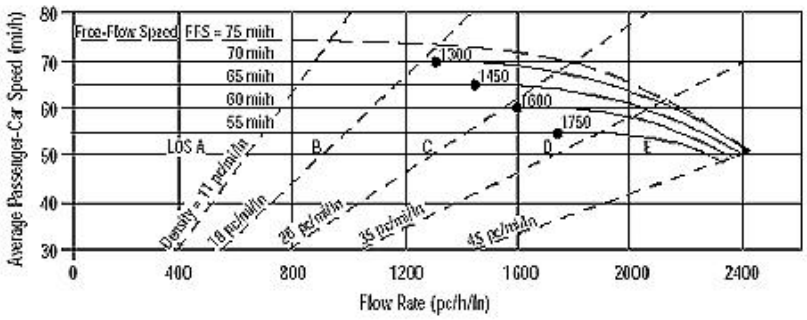
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 on to Exit 4 on*
Date Performed	*12/13/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 No-Build*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1116*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*19.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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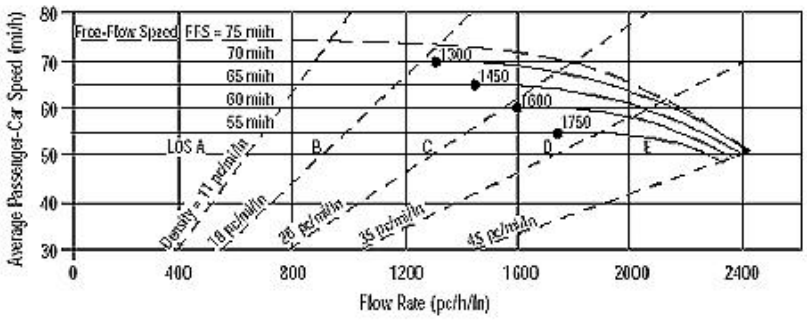
DIAMOND

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3300*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1208*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*21.6*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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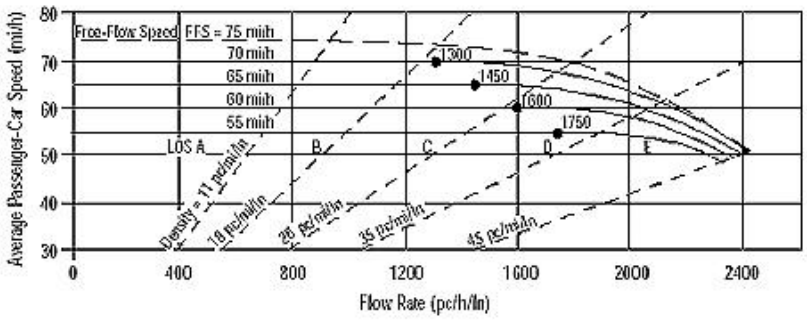

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1903*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.7*	mi/h	S	mi/h
D = v_p / S	*34.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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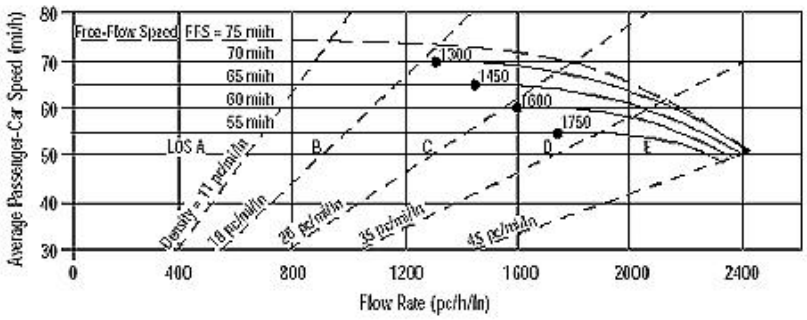

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*897*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*16.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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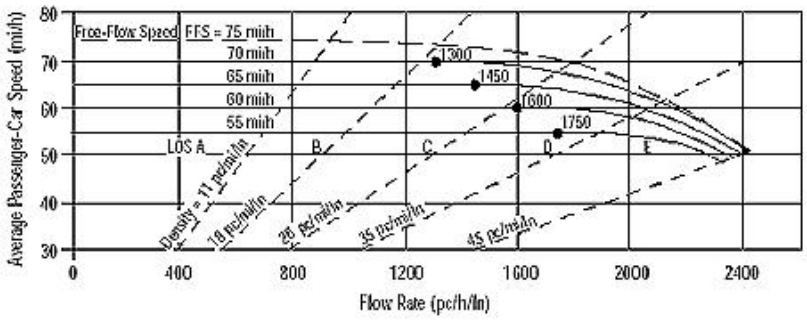

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4700*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1720*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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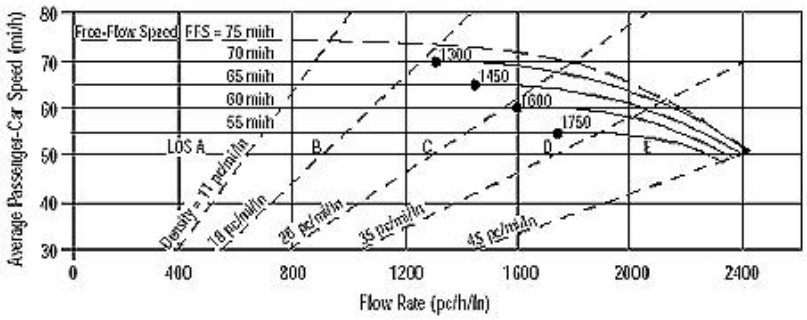

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*915*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*16.3*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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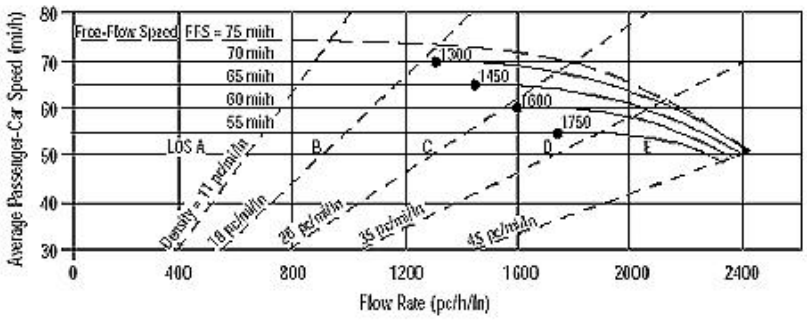

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5350*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1958*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*55.3*	mi/h	S		mi/h
D = v_p / S	*35.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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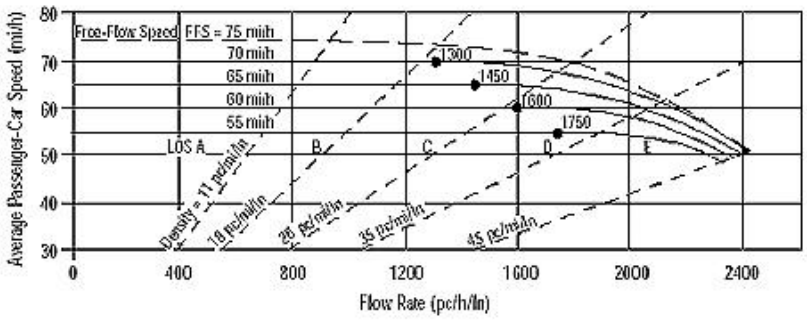

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/29/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2400*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*659*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*11.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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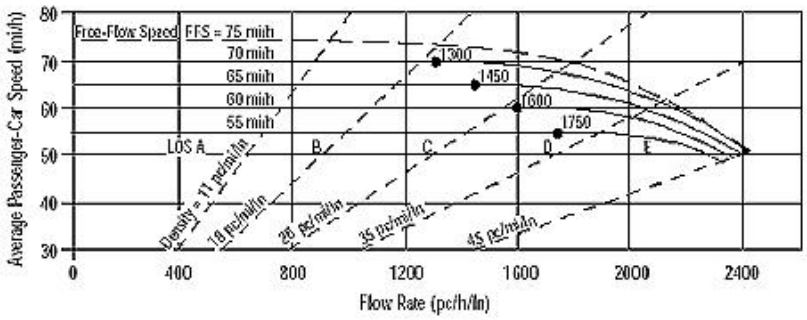

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/29/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1674*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*29.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 660 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2900	0.92	Level	2	0	0.990	1.00	3184
Ramp	380	0.92	Level	2	0	0.990	1.00	417
UpStream	660	0.92	Level	2	0	0.990	1.00	725
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 837.81 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1915 pc/h
V_3 or V_{av34} 1269 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3601	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2332	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 18.1 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.293 (Exibit 25-19)
S_R= 51.9 mph (Exhibit 25-19)
S_0= 53.2 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1850 ft
V_D = 560 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3300	0.92	Level	2	0	0.990	1.00	3623
Ramp	850	0.82	Level	2	0	0.990	1.00	1047
UpStream								
DownStream	560	0.92	Level	2	0	0.990	1.00	615

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.621 using Equation (Exhibit 25-12)
V_{12} = 2647 pc/h
V_3 or V_{av34} 976 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3623	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2576	Exhibit 25-14	6780	No
V_R	1047	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2647	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 20.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.457 (Exhibit 25-19)
S_R= 49.6 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1850 ft
V_u = 850 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2450	0.92	Level	2	0	0.990	1.00	2690
Ramp	560	0.92	Level	2	0	0.990	1.00	615
UpStream	850	0.96	Level	2	0	0.990	1.00	894
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 978.71 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1652 pc/h
V_3 or V_{av34} 1038 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3305	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2267	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 14.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.254 (Exibit 25-19)
S_R= 52.4 mph (Exhibit 25-19)
S_0= 54.1 mph (Exhibit 25-19)
S = 52.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 7810 ft
V_u = 560 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2500	0.92	Level	2	0	0.990	1.00	2745
Ramp	490	0.96	Level	2	0	0.990	1.00	516
UpStream	560	0.92	Level	2	0	0.990	1.00	615
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 6479.21 (Equation 25-8 or 25-9)
P_{FD} = 0.668 using Equation (Exhibit 25-12)
V_{12} = 2004 pc/h
V_3 or V_{av34} 741 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Diverge Areas

	Actual	Capacity		LOS F?
V_F	2745	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2229	Exhibit 25-14	6780	No
V_R	516	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2004	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 19.2 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination — Diverge Areas

D_s = 0.474 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 56.0 mph S_{FR} = 40.0 mph	L_{down} = 1300 ft
V_u = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	V_D = 340 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5200	0.92	Level	2	0	0.990	1.00	5709
Ramp	930	0.92	Level	2	0	0.990	1.00	1021
UpStream								
DownStream	340	0.92	Level	2	0	0.990	1.00	373

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.570 using Equation (Exhibit 25-12)

V_{12} = 3695 pc/h

V_3 or V_{av34} 2014 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5709	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4688	Exhibit 25-14	6780	No
V_R	1021	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3695	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 33.3 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.455 (Exhibit 25-19)

S_R= 49.6 mph (Exhibit 25-19)

S_0= 57.5 mph (Exhibit 25-19)

S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1820 ft
V_D = 510 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5350	0.92	Level	2	0	0.990	1.00	5873
Ramp	630	0.92	Level	2	0	0.990	1.00	692
UpStream								
DownStream	510	0.93	Level	5	0	0.976	1.00	562

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.581 using Equation (Exhibit 25-12)
V_{12} = 3704 pc/h
V_3 or V_{av34} 2169 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5873	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5181	Exhibit 25-14	6780	No
V_R	692	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3704	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 29.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.425 (Exhibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 56.9 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1820 ft
V_u = 630 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4700	0.92	Level	2	0	0.990	1.00	5160
Ramp	510	0.93	Level	5	0	0.976	1.00	562
UpStream	630	0.92	Level	2	0	0.990	1.00	692
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1493.73 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3168 pc/h
V_3 or V_{av34} 1992 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5722	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3730	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 26.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.379 (Exibit 25-19)
S_R= 50.7 mph (Exhibit 25-19)
S_0= 50.6 mph (Exhibit 25-19)
S = 50.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 6100 ft
V_D = 630 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5100	0.92	Level	2	0	0.990	1.00	5599
Ramp	250	0.93	Level	3	0	0.985	1.00	273
UpStream								
DownStream	630	0.92	Level	2	0	0.990	1.00	692

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2782.47 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3437 pc/h
V_3 or V_{av34} 2162 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5872	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3710	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.376 (Exibit 25-19)
S_R= 50.7 mph (Exhibit 25-19)
S_0= 50.0 mph (Exhibit 25-19)
S = 50.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2016 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.27
Weaving seg length, L (ft)	815	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2600	0.92	2	0	1.5	1.2	0.990	1.00	2854
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	660	0.92	2	0	1.5	1.2	0.990	1.00	724
V_{w2}	300	0.92	2	0	1.5	1.2	0.990	1.00	329
V_w				1053	V_{nw}				2854
V									3907

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.94	0.46		
Weaving and non-weaving speeds, Si (mi/h)	38.65	46.52		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	44.10
Weaving segment density, D (pc/mi/ln)	22.15
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6357
Capacity as a 15-minute flow rate, c (veh/h)	6294
Capacity as a full-hour volume, c_h (veh/h)	5790

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2016 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	810	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3530	0.92	2	0	1.5	1.2	0.990	1.00	3875
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	720	0.92	2	0	1.5	1.2	0.990	1.00	790
V_{w2}	340	0.92	2	0	1.5	1.2	0.990	1.00	373
V_w				1163	V_{nw}				3875
V									5038

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.13	0.57		
Weaving and non-weaving speeds, Si (mi/h)	36.55	44.35		

Number of lanes required for unconstrained operation, Nw 1.27
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.27
Weaving segment density, D (pc/mi/ln)	29.80
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6565
Capacity as a 15-minute flow rate, c (veh/h)	6500
Capacity as a full-hour volume, c_h (veh/h)	5980

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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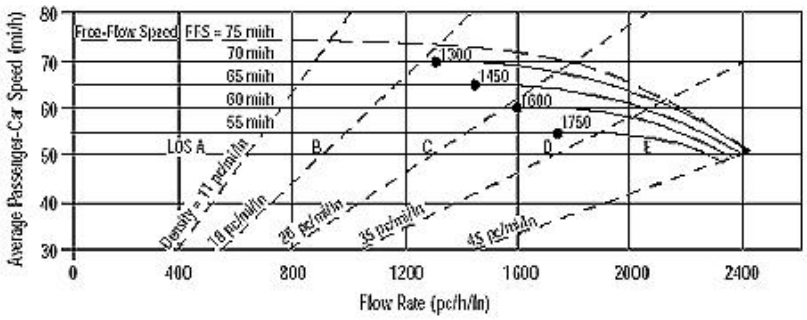
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1281*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*22.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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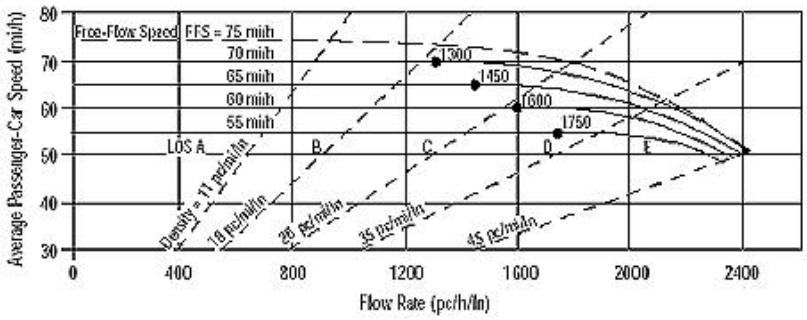
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5250*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1921*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*55.6*	mi/h	S		mi/h
D = v_p / S	*34.6*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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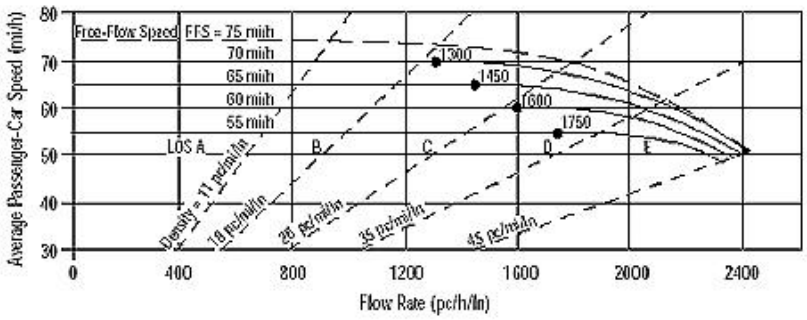
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*933*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*16.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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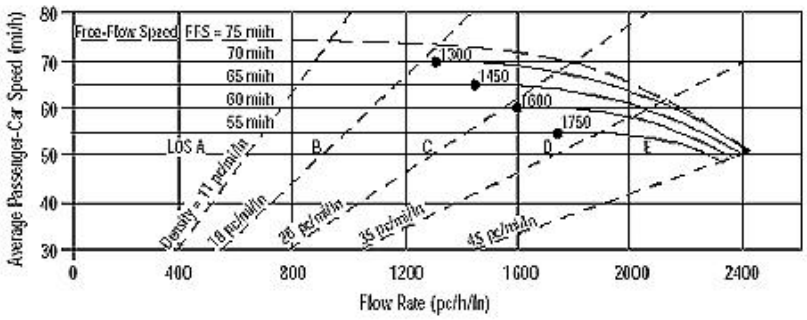
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4900*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1793*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*32.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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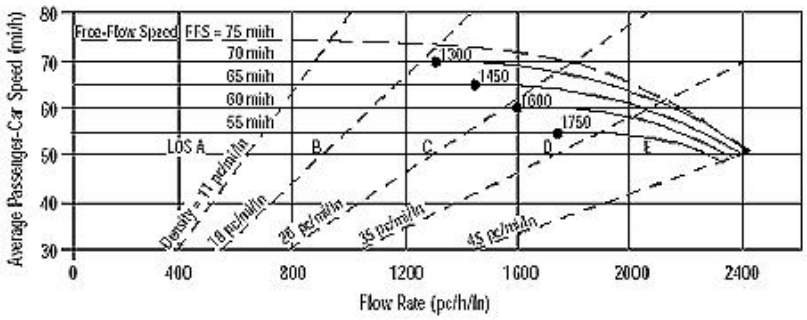

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*951*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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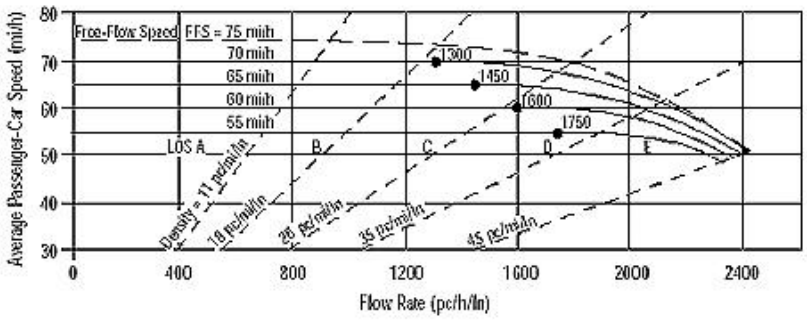
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2049*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*54.4*	mi/h	S	mi/h
D = v_p / S	*37.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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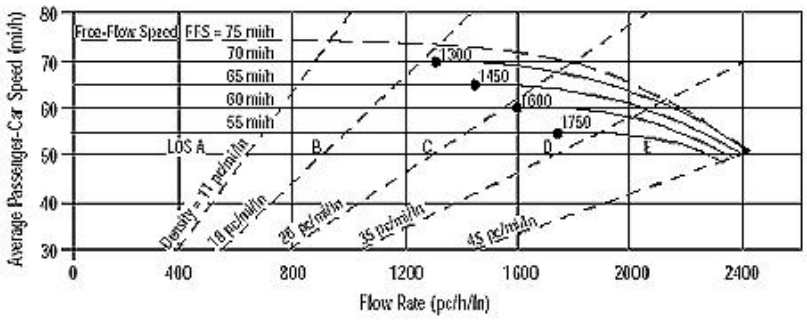

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*7/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*700*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*12.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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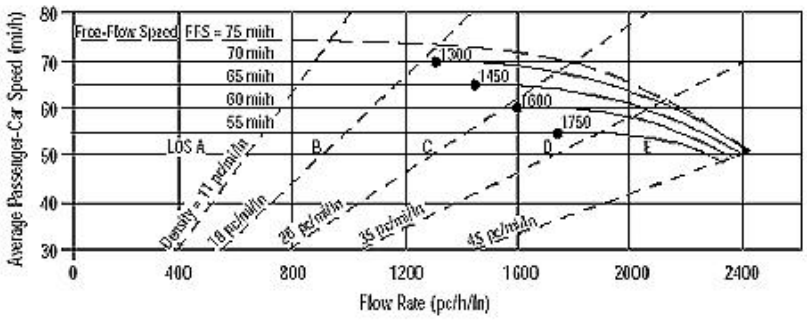
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1702*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 670 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3100	0.92	Level	2	0	0.990	1.00	3403
Ramp	390	0.92	Level	2	0	0.990	1.00	428
UpStream	670	0.92	Level	2	0	0.990	1.00	736
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 887.03 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 2046 pc/h
V_3 or V_{av34} 1357 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3831	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2474	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.2 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.299 (Exibit 25-19)
S_R= 51.8 mph (Exhibit 25-19)
S_0= 52.9 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1850 ft
V_D = 570 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3500	0.92	Level	2	0	0.990	1.00	3842
Ramp	950	0.82	Level	2	0	0.990	1.00	1170
UpStream								
DownStream	570	0.92	Level	2	0	0.990	1.00	626

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.610 using Equation (Exhibit 25-12)
V_{12} = 2800 pc/h
V_3 or V_{av34} 1042 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3842	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2672	Exhibit 25-14	6780	No
V_R	1170	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2800	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 22.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.468 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 61.3 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1850 ft
V_u = 950 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2550	0.92	Level	2	0	0.990	1.00	2799
Ramp	570	0.92	Level	2	0	0.990	1.00	626
UpStream	950	0.96	Level	2	0	0.990	1.00	999
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1004.39 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1719 pc/h
V_3 or V_{av34} 1080 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3425	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2345	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 15.3 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.257 (Exibit 25-19)
S_R= 52.4 mph (Exhibit 25-19)
S_0= 53.9 mph (Exhibit 25-19)
S = 52.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 7810 ft
V_u = 570 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2600	0.92	Level	2	0	0.990	1.00	2854
Ramp	490	0.96	Level	2	0	0.990	1.00	516
UpStream	570	0.92	Level	2	0	0.990	1.00	626
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 6425.39 (Equation 25-8 or 25-9)
P_{FD} = 0.665 using Equation (Exhibit 25-12)
V_{12} = 2071 pc/h
V_3 or V_{av34} 783 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2854	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2338	Exhibit 25-14	6780	No
V_R	516	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2071	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 19.8 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.474 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 340 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5250	0.92	Level	2	0	0.990	1.00	5764
Ramp	940	0.92	Level	2	0	0.990	1.00	1032
UpStream								
DownStream	340	0.92	Level	2	0	0.990	1.00	373

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.568 using Equation (Exhibit 25-12)
V_{12} = 3722 pc/h
V_3 or V_{av34} 2042 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5764	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4732	Exhibit 25-14	6780	No
V_R	1032	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3722	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.456 (Exhibit 25-19)
S_R = 49.6 mph (Exhibit 25-19)
S_0 = 57.4 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1820 ft
V_D = 510 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5600	0.92	Level	2	0	0.990	1.00	6148
Ramp	690	0.92	Level	2	0	0.990	1.00	757
UpStream								
DownStream	510	0.93	Level	5	0	0.976	1.00	562

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.571 using Equation (Exhibit 25-12)
V_{12} = 3838 pc/h
V_3 or V_{av34} 2310 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6148	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5391	Exhibit 25-14	6780	No
V_R	757	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3838	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 31.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.431 (Exhibit 25-19)
S_R = 50.0 mph (Exhibit 25-19)
S_0 = 56.3 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1820 ft
V_u = 690 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4900	0.92	Level	2	0	0.990	1.00	5379
Ramp	510	0.93	Level	5	0	0.976	1.00	562
UpStream	690	0.92	Level	2	0	0.990	1.00	757
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1540.59 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3303 pc/h
V_3 or V_{av34} 2076 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5941	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3865	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 27.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.403 (Exibit 25-19)
S_R= 50.4 mph (Exhibit 25-19)
S_0= 50.3 mph (Exhibit 25-19)
S = 50.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 6100 ft
V_D = 690 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5300	0.92	Level	2	0	0.990	1.00	5818
Ramp	300	0.93	Level	3	0	0.985	1.00	327
UpStream								
DownStream	690	0.92	Level	2	0	0.990	1.00	757

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = 3043.83 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3572 pc/h
V_3 or V_{av34} 2246 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	6145	Exhibit 25-7		No

Capacity Checks — Diverge Areas

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3899	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 27.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = 0.409 (Exibit 25-19)
S_R= 50.3 mph (Exhibit 25-19)
S_0= 49.7 mph (Exhibit 25-19)
S = 50.1 mph (Exhibit 25-14)

Speed Determination — Diverge Areas

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2026 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.26
Weaving seg length, L (ft)	815	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2790	0.92	2	0	1.5	1.2	0.990	1.00	3062
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	670	0.92	2	0	1.5	1.2	0.990	1.00	735
V_{w2}	310	0.92	2	0	1.5	1.2	0.990	1.00	340
V_w				1075	V_{nw}				3062
V									4137

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.98	0.48		
Weaving and non-weaving speeds, Si (mi/h)	38.21	46.09		

Number of lanes required for unconstrained operation, Nw 1.33
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.74
Weaving segment density, D (pc/mi/ln)	23.64
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6411
Capacity as a 15-minute flow rate, c (veh/h)	6348
Capacity as a full-hour volume, c_h (veh/h)	5840

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2026 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3550	0.92	2	0	1.5	1.2	0.990	1.00	3897
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	750	0.92	2	0	1.5	1.2	0.990	1.00	823
V_{w2}	340	0.92	2	0	1.5	1.2	0.990	1.00	373
V_w				1196	V_{nw}				3897
V									5093

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.16	0.58		
Weaving and non-weaving speeds, Si (mi/h)	36.35	44.06		

Number of lanes required for unconstrained operation, Nw 1.29
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.97
Weaving segment density, D (pc/mi/ln)	30.34
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6543
Capacity as a 15-minute flow rate, c (veh/h)	6478
Capacity as a full-hour volume, c_h (veh/h)	5960

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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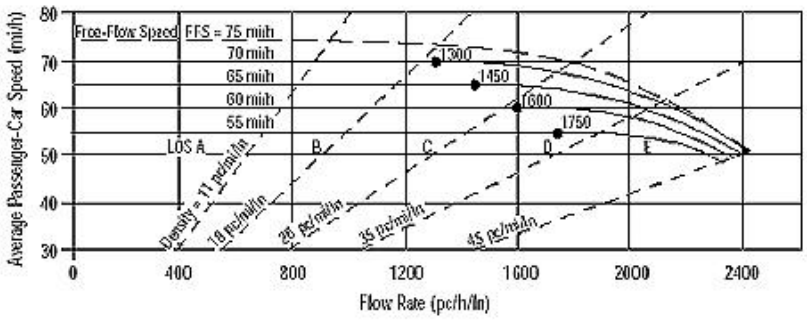
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1336*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*23.9*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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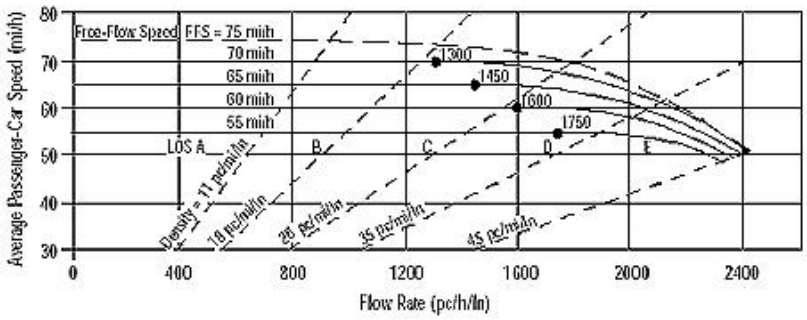
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5300*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1939*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.4*	mi/h	S	mi/h
D = v_p / S	*35.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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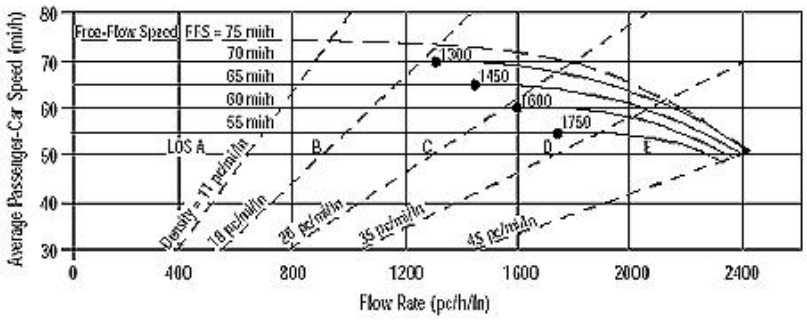

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2560*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*937*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*16.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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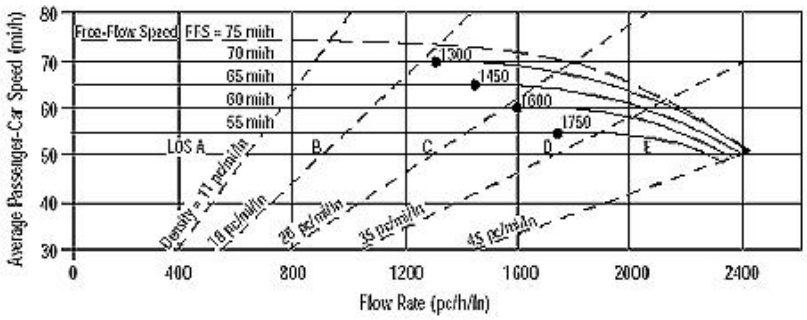

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1866*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.8*	mi/h	S	mi/h
D = v_p / S	*33.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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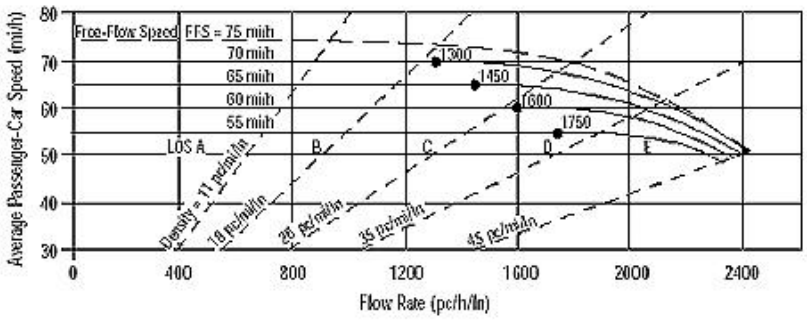
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*970*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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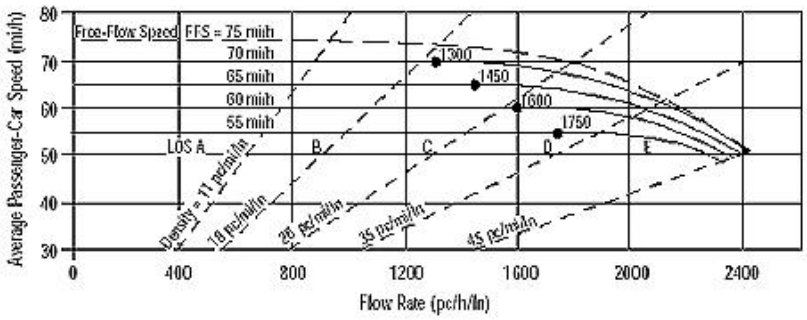
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2141*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*53.0*	mi/h	S		mi/h
D = v_p / S	*40.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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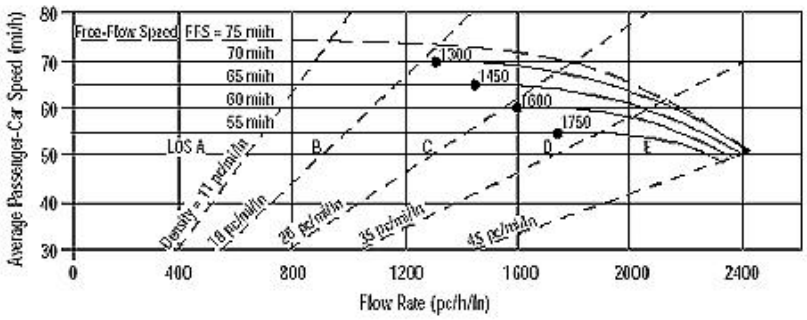
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*700*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*12.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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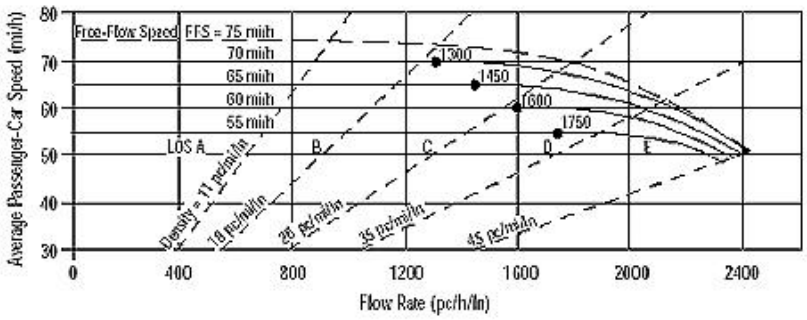
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6300*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1729*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 680 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3250	0.92	Level	2	0	0.990	1.00	3568
Ramp	400	0.92	Level	2	0	0.990	1.00	439
UpStream	680	0.92	Level	2	0	0.990	1.00	747
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 924.70 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 2145 pc/h
V_3 or V_{av34} 1423 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4007	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2584	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.305 (Exibit 25-19)
S_R= 51.7 mph (Exhibit 25-19)
S_0= 52.7 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1850 ft
V_D = 590 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3650	0.92	Level	2	0	0.990	1.00	4007
Ramp	1060	0.82	Level	2	0	0.990	1.00	1306
UpStream								
DownStream	590	0.92	Level	2	0	0.990	1.00	648

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.600 using Equation (Exhibit 25-12)
V_{12} = 2926 pc/h
V_3 or V_{av34} 1081 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4007	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2701	Exhibit 25-14	6780	No
V_R	1306	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2926	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 23.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.481 (Exhibit 25-19)
S_R = 49.3 mph (Exhibit 25-19)
S_0 = 61.1 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1850 ft
V_u = 1060 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2560	0.92	Level	2	0	0.990	1.00	2810
Ramp	590	0.92	Level	2	0	0.990	1.00	648
UpStream	1060	0.96	Level	2	0	0.990	1.00	1115
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1011.45 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1726 pc/h
V_3 or V_{av34} 1084 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3458	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2374	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.258 (Exibit 25-19)
S_R= 52.4 mph (Exhibit 25-19)
S_0= 53.9 mph (Exhibit 25-19)
S = 52.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 7810 ft
V_u = 590 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2650	0.92	Level	2	0	0.990	1.00	2909
Ramp	500	0.96	Level	2	0	0.990	1.00	526
UpStream	590	0.92	Level	2	0	0.990	1.00	648
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 6616.90 (Equation 25-8 or 25-9)
P_{FD} = 0.663 using Equation (Exhibit 25-12)
V_{12} = 2106 pc/h
V_3 or V_{av34} 803 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2909	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2383	Exhibit 25-14	6780	No
V_R	526	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2106	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 20.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.475 (Exhibit 25-19)
S_R= 49.3 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = 1300 ft
V_u = veh/h	S_{FF} = 56.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = 350 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5300	0.92	Level	2	0	0.990	1.00	5818
Ramp	960	0.92	Level	2	0	0.990	1.00	1054
UpStream								
DownStream	350	0.92	Level	2	0	0.990	1.00	384

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R = mph (Exhibit 25-19)

S_0 = mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.566 using Equation (Exhibit 25-12)

V_{12} = 3751 pc/h

V_3 or V_{av34} 2067 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5818	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4764	Exhibit 25-14	6780	No
V_R	1054	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3751	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 33.8 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.458 (Exhibit 25-19)

S_R = 49.6 mph (Exhibit 25-19)

S_0 = 57.3 mph (Exhibit 25-19)

S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1820 ft
V_D = 510 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5850	0.92	Level	2	0	0.990	1.00	6422
Ramp	760	0.92	Level	2	0	0.990	1.00	834
UpStream								
DownStream	510	0.93	Level	5	0	0.976	1.00	562

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.561 using Equation (Exhibit 25-12)
V_{12} = 3969 pc/h
V_3 or V_{av34} 2453 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6422	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5588	Exhibit 25-14	6780	No
V_R	834	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3969	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 32.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.438 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 55.8 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1820 ft
V_u = 760 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5100	0.92	Level	2	0	0.990	1.00	5599
Ramp	510	0.93	Level	5	0	0.976	1.00	562
UpStream	760	0.92	Level	2	0	0.990	1.00	834
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1587.67 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3438 pc/h
V_3 or V_{av34} 2161 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6161	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4000	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 28.2 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.430 (Exibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 50.0 mph (Exhibit 25-19)
S = 50.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 6100 ft
V_D = 760 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5500	0.92	Level	2	0	0.990	1.00	6038
Ramp	370	0.93	Level	3	0	0.985	1.00	404
UpStream								
DownStream	760	0.92	Level	2	0	0.990	1.00	834

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 3353.44 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3707 pc/h
V_3 or V_{av34} 2331 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6442	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4111	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 29.2 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.455 (Exibit 25-19)
S_R= 49.6 mph (Exhibit 25-19)
S_0= 49.3 mph (Exhibit 25-19)
S = 49.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2036 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.25
Weaving seg length, L (ft)	815	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2930	0.92	2	0	1.5	1.2	0.990	1.00	3216
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	680	0.92	2	0	1.5	1.2	0.990	1.00	746
V_{w2}	320	0.92	2	0	1.5	1.2	0.990	1.00	351
V_w				1097	V_{nw}				3216
V									4313

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.01	0.50		
Weaving and non-weaving speeds, Si (mi/h)	37.86	45.72		

Number of lanes required for unconstrained operation, Nw 1.32
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.42
Weaving segment density, D (pc/mi/ln)	24.83
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6442
Capacity as a 15-minute flow rate, c (veh/h)	6378
Capacity as a full-hour volume, c_h (veh/h)	5868

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2036 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.24
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3570	0.92	2	0	1.5	1.2	0.990	1.00	3919
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	780	0.92	2	0	1.5	1.2	0.990	1.00	856
V_{w2}	350	0.92	2	0	1.5	1.2	0.990	1.00	384
V_w				1240	V_{nw}				3919
V									5159

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.18	0.60		
Weaving and non-weaving speeds, Si (mi/h)	36.09	43.69		

Number of lanes required for unconstrained operation, Nw 1.31
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.59
Weaving segment density, D (pc/mi/ln)	31.01
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6512
Capacity as a 15-minute flow rate, c (veh/h)	6448
Capacity as a full-hour volume, c_h (veh/h)	5932

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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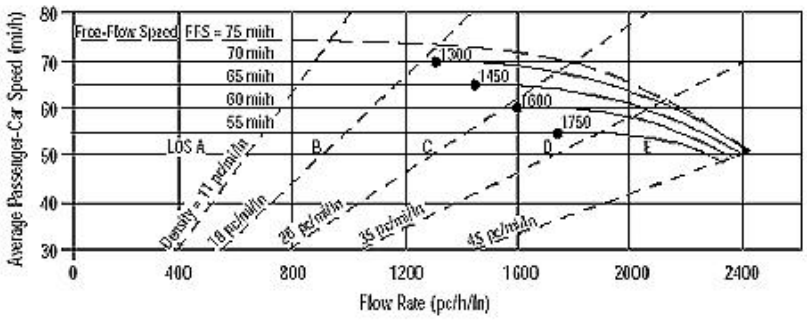
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*951*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*17.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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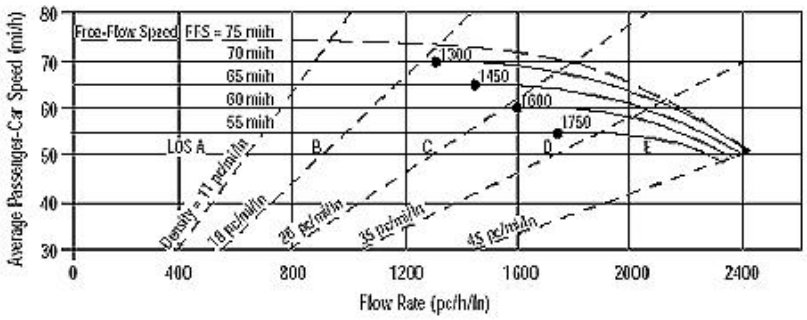

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1848*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.9*	mi/h	S	mi/h
D = v_p / S	*33.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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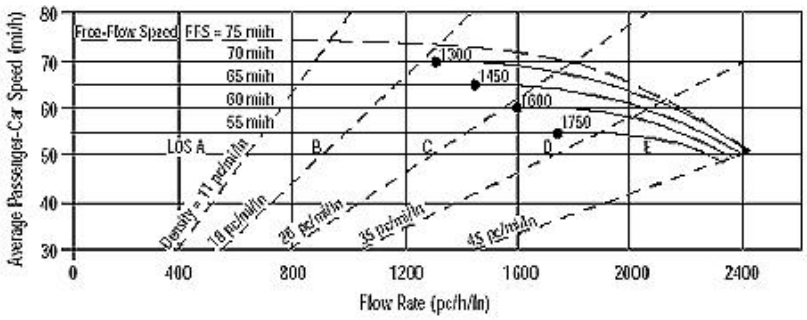

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*12/12/2011*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*970*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*17.3*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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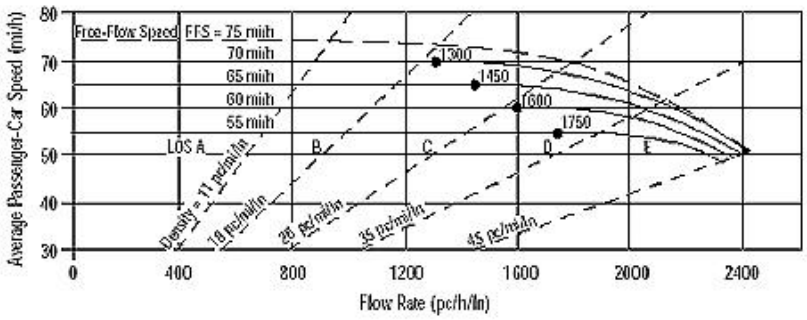

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2141*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*53.0*	mi/h	S		mi/h
D = v_p / S	*40.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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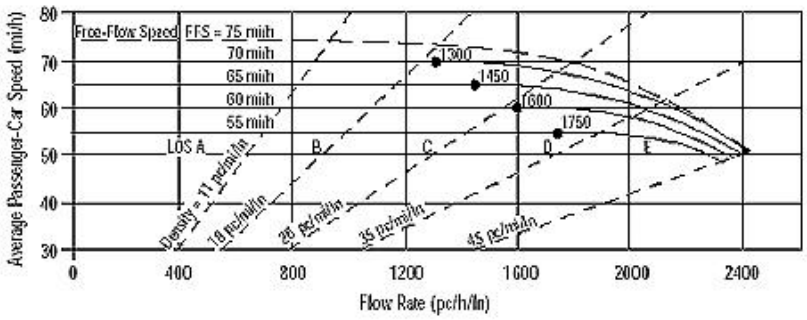

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5400*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2114*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*53.5*	mi/h	S	mi/h
D = v_p / S	*39.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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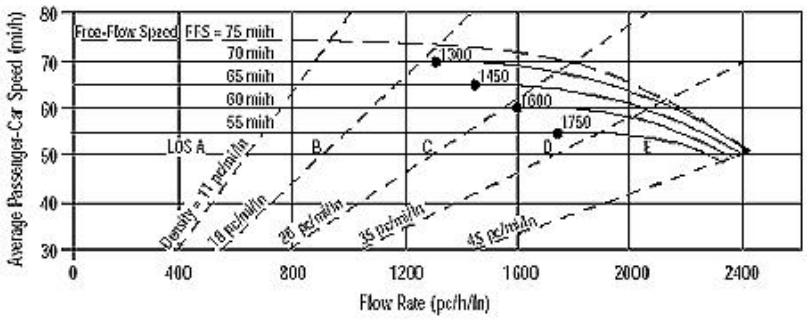

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1409*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*25.2*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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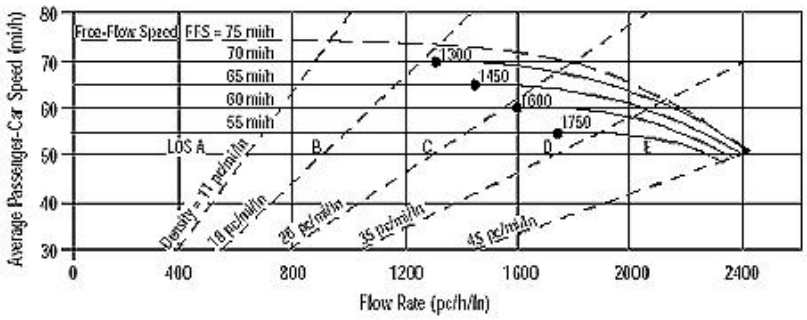

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4450*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1742*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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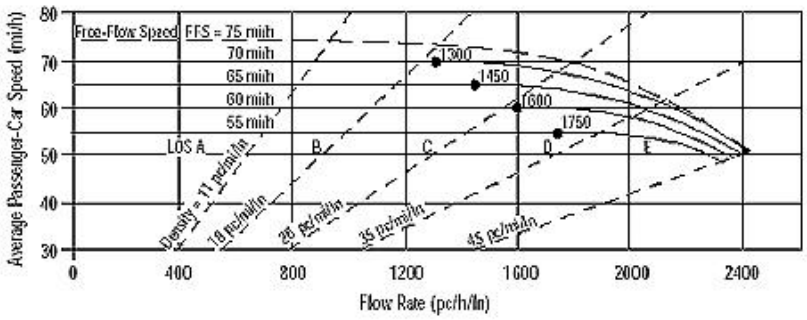

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2700*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*988*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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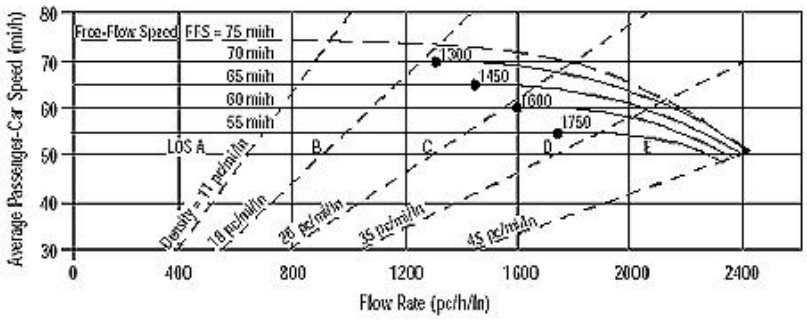
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5650*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2212*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*51.5*	mi/h	S		mi/h
D = v_p / S	*43.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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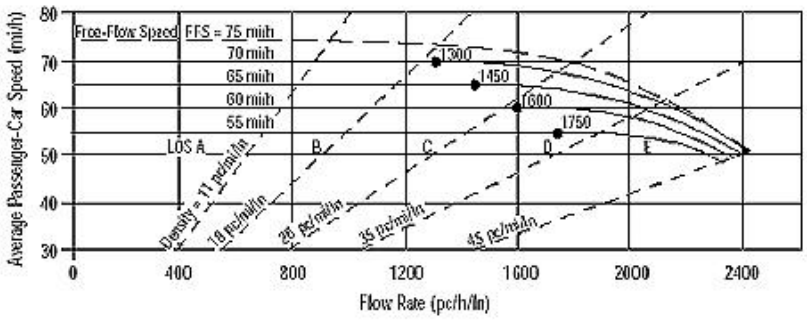
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1336*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*23.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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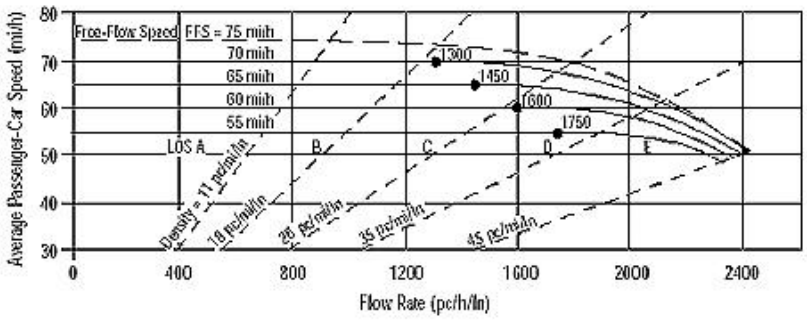

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/29/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5750*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1688*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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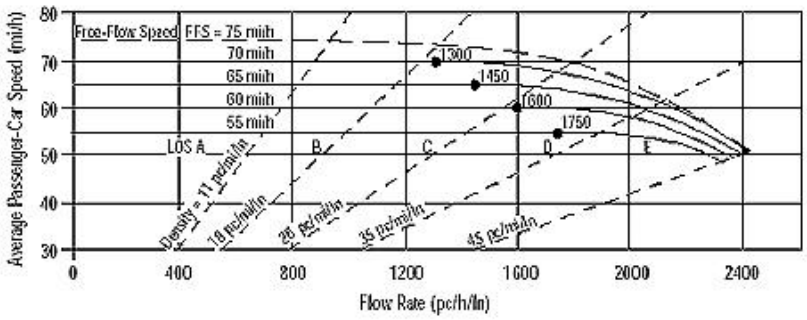

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*7/29/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*961*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 800 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4650	0.86	Level	2	0	0.990	1.00	5461
Ramp	770	0.92	Level	2	0	0.990	1.00	845
UpStream	800	0.92	Level	2	0	0.990	1.00	878
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1416.68 (Equation 25-2 or 25-3)
P_{FM} = 0.581 using Equation (Exhibit 25-5)
V_{12} = 3174 pc/h
V_3 or V_{av34} 2287 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6306	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4019	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 31.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.470 (Exibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 49.6 mph (Exhibit 25-19)
S = 49.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1850 ft
V_D = 880 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5400	0.86	Level	2	0	0.990	1.00	6342
Ramp	960	0.86	Level	2	0	0.990	1.00	1127
UpStream								
DownStream	880	0.88	Level	1	0	0.995	1.00	1005

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.550 using Equation (Exhibit 25-12)
V_{12} = 3993 pc/h
V_3 or V_{av34} 2349 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6342	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5215	Exhibit 25-14	6780	No
V_R	1127	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3993	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 32.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.464 (Exhibit 25-19)
S_R= 49.5 mph (Exhibit 25-19)
S_0= 56.2 mph (Exhibit 25-19)
S = 51.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1850 ft
V_u = 960 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4450	0.86	Level	2	0	0.990	1.00	5226
Ramp	880	0.88	Level	1	0	0.995	1.00	1005
UpStream	960	0.92	Level	3	0	0.985	1.00	1059
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1604.87 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3210 pc/h
V_3 or V_{av34} 2016 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6231	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4215	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 29.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.480 (Exibit 25-19)
S_R= 49.3 mph (Exhibit 25-19)
S_0= 50.5 mph (Exhibit 25-19)
S = 49.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 7810 ft
V_u = 880 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5650	0.86	Level	2	0	0.990	1.00	6635
Ramp	410	0.92	Level	3	0	0.985	1.00	452
UpStream	880	0.88	Level	1	0	0.995	1.00	1005
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 5310.35 (Equation 25-8 or 25-9)
P_{FD} = 0.573 using Equation (Exhibit 25-12)
V_{12} = 3997 pc/h
V_3 or V_{av34} 2638 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6635	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	6183	Exhibit 25-14	6780	No
V_R	452	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3997	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 36.4 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.469 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 55.0 mph (Exhibit 25-19)
S = 51.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = 1300 ft
V_u = veh/h	S_{FF} = 56.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = 680 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3850	0.92	Level	2	0	0.990	1.00	4227
Ramp	540	0.92	Level	2	0	0.990	1.00	593
UpStream								
DownStream	680	0.92	Level	2	0	0.990	1.00	747

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R = mph (Exhibit 25-19)

S_0 = mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.627 using Equation (Exhibit 25-12)

V_{12} = 2872 pc/h

V_3 or V_{av34} 1355 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4227	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3634	Exhibit 25-14	6780	No
V_R	593	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2872	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 26.3 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.416 (Exhibit 25-19)

S_R = 50.2 mph (Exhibit 25-19)

S_0 = 60.0 mph (Exhibit 25-19)

S = 53.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1820 ft
V_D = 1280 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3650	0.92	Level	2	0	0.990	1.00	4007
Ramp	970	0.92	Level	2	0	0.990	1.00	1065
UpStream								
DownStream	1280	0.93	Level	4	0	0.980	1.00	1404

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.611 using Equation (Exhibit 25-12)
V_{12} = 2862 pc/h
V_3 or V_{av34} 1145 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4007	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2942	Exhibit 25-14	6780	No
V_R	1065	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2862	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 22.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.459 (Exhibit 25-19)
S_R= 49.6 mph (Exhibit 25-19)
S_0= 60.9 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1820 ft
V_u = 970 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2700	0.92	Level	2	0	0.990	1.00	2964
Ramp	1280	0.93	Level	4	0	0.980	1.00	1404
UpStream	970	0.92	Level	2	0	0.990	1.00	1065
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1203.97 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1820 pc/h
V_3 or V_{av34} 1144 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4368	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3224	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 21.8 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.315 (Exibit 25-19)
S_R= 51.6 mph (Exhibit 25-19)
S_0= 53.7 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 6100 ft
V_D = 970 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.92	Level	2	0	0.990	1.00	3293
Ramp	630	0.87	Level	1	0	0.995	1.00	728
UpStream								
DownStream	970	0.92	Level	2	0	0.990	1.00	1065

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 4282.27 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2022 pc/h
V_3 or V_{av34} 1271 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4021	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2750	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 18.4 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.278 (Exibit 25-19)
S_R = 52.1 mph (Exhibit 25-19)
S_0 = 53.2 mph (Exhibit 25-19)
S = 52.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2016 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.21
Weaving seg length, L (ft)	815	Weaving ratio, R	0.35
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	4220	0.86	2	0	1.5	1.2	0.990	1.00	4956
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	800	0.92	2	0	1.5	1.2	0.990	1.00	878
V_{w2}	430	0.92	2	0	1.5	1.2	0.990	1.00	472
V_w				1350	V_{nw}				4956
V									6306

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.36	0.72		
Weaving and non-weaving speeds, Si (mi/h)	34.47	41.81		

Number of lanes required for unconstrained operation, Nw 1.25
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.99
Weaving segment density, D (pc/mi/ln)	39.42
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6665
Capacity as a 15-minute flow rate, c (veh/h)	6599
Capacity as a full-hour volume, c_h (veh/h)	5764

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2016 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.19
Weaving seg length, L (ft)	810	Weaving ratio, R	0.10
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3220	0.92	2	0	1.5	1.2	0.990	1.00	3534
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	680	0.92	2	0	1.5	1.2	0.990	1.00	746
V_{w2}	80	0.92	2	0	1.5	1.2	0.990	1.00	87
V_w				833	V_{nw}				3534
V									4367

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.92	0.41		
Weaving and non-weaving speeds, Si (mi/h)	38.98	47.56		

Number of lanes required for unconstrained operation, Nw 1.11
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	45.65
Weaving segment density, D (pc/mi/ln)	23.92
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6788
Capacity as a 15-minute flow rate, c (veh/h)	6721
Capacity as a full-hour volume, c_h (veh/h)	6183

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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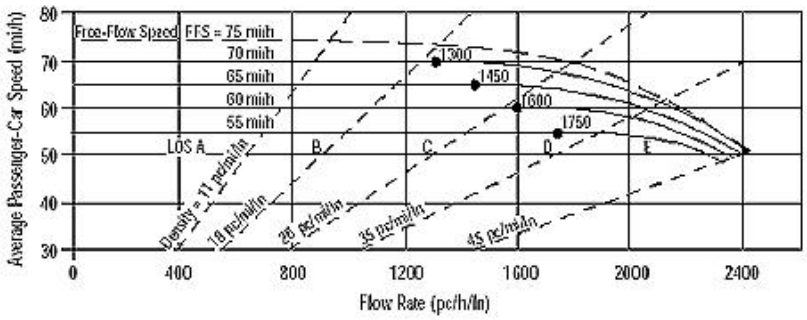
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5450*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2134*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*53.1*	mi/h	S		mi/h
D = v_p / S	*40.2*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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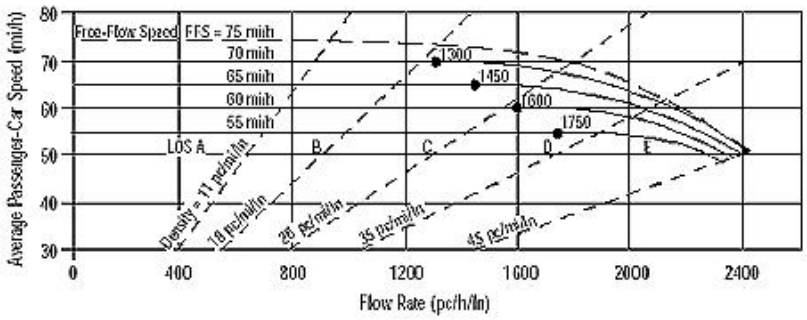

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3950*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1445*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*25.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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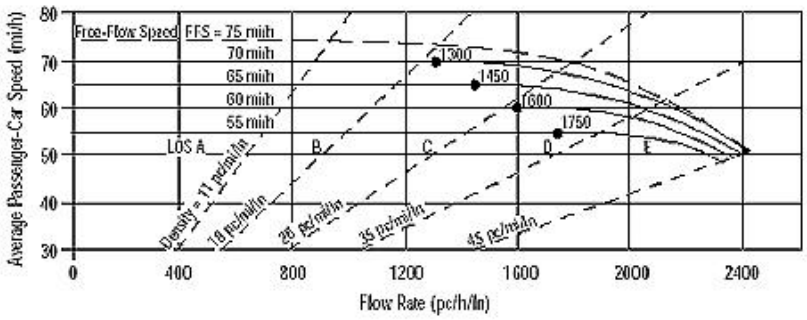

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4450*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1742*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*31.1*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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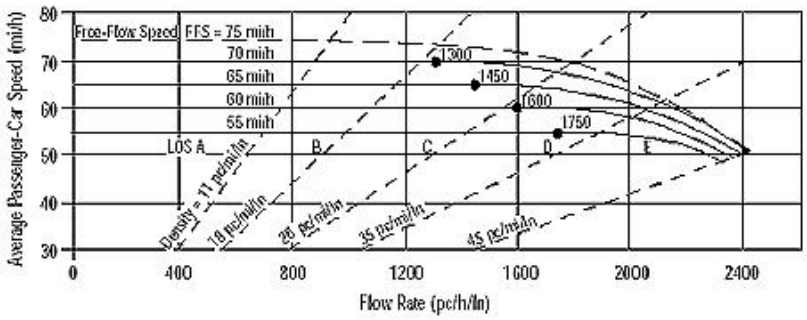
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1006*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*18.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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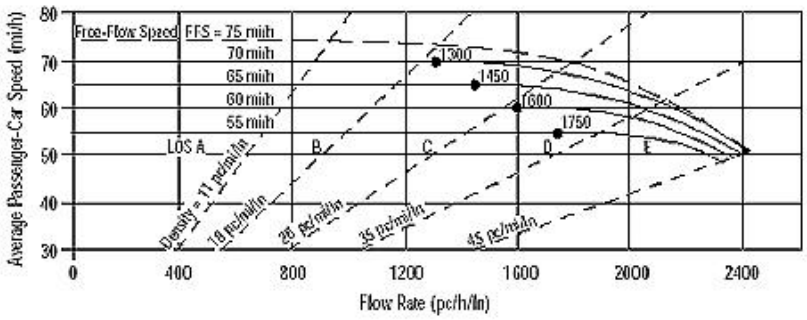

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5700*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2231*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*51.0*	mi/h	S		mi/h
D = v_p / S	*43.7*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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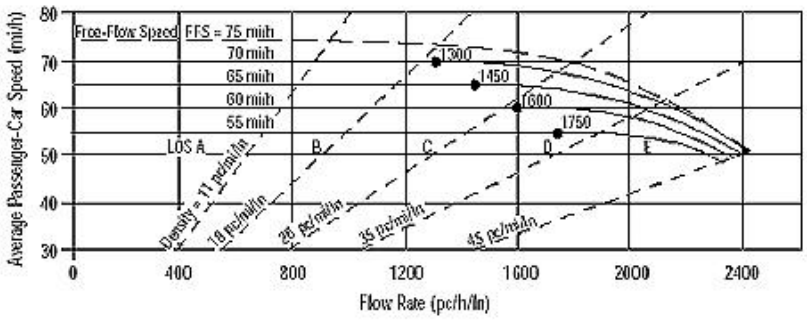
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1391*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*24.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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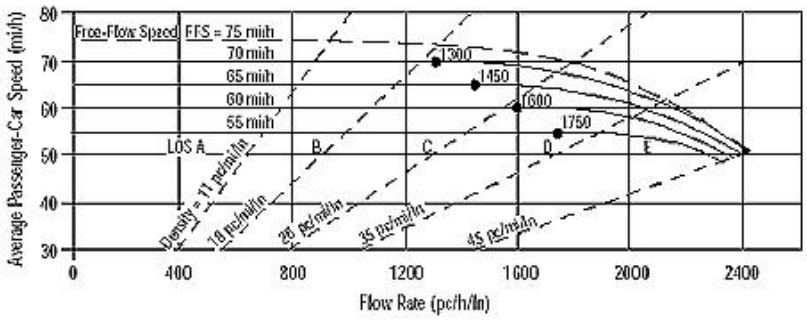
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5900*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1732*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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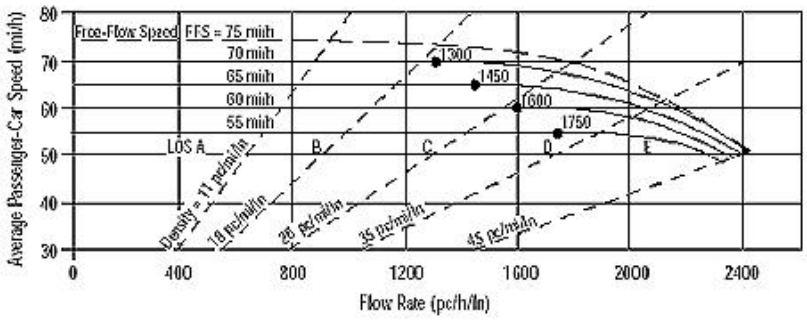
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3625*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*995*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 840 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4650	0.86	Level	2	0	0.990	1.00	5461
Ramp	780	0.92	Level	2	0	0.990	1.00	856
UpStream	840	0.92	Level	2	0	0.990	1.00	922
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1419.04 (Equation 25-2 or 25-3)
P_{FM} = 0.581 using Equation (Exhibit 25-5)
V_{12} = 3173 pc/h
V_3 or V_{av34} 2288 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6317	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4029	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 31.2 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.472 (Exibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 49.6 mph (Exhibit 25-19)
S = 49.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1850 ft
V_D = 930 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5450	0.86	Level	2	0	0.990	1.00	6401
Ramp	980	0.86	Level	2	0	0.990	1.00	1151
UpStream								
DownStream	930	0.88	Level	1	0	0.995	1.00	1062

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.547 using Equation (Exhibit 25-12)
V_{12} = 4023 pc/h
V_3 or V_{av34} 2378 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6401	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5250	Exhibit 25-14	6780	No
V_R	1151	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4023	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 32.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.467 (Exhibit 25-19)
S_R= 49.5 mph (Exhibit 25-19)
S_0= 56.1 mph (Exhibit 25-19)
S = 51.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1850 ft
V_u = 980 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4450	0.86	Level	2	0	0.990	1.00	5226
Ramp	930	0.88	Level	1	0	0.995	1.00	1062
UpStream	980	0.92	Level	3	0	0.985	1.00	1081
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1617.07 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3210 pc/h
V_3 or V_{av34} 2016 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6288	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4272	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 30.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.496 (Exibit 25-19)
S_R= 49.1 mph (Exhibit 25-19)
S_0= 50.5 mph (Exhibit 25-19)
S = 49.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 7810 ft
V_u = 930 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5700	0.86	Level	2	0	0.990	1.00	6694
Ramp	420	0.92	Level	3	0	0.985	1.00	463
UpStream	930	0.88	Level	1	0	0.995	1.00	1062
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 5596.13 (Equation 25-8 or 25-9)
P_{FD} = 0.571 using Equation (Exhibit 25-12)
V_{12} = 4023 pc/h
V_3 or V_{av34} 2671 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6694	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	6231	Exhibit 25-14	6780	No
V_R	463	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4023	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 36.6 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.470 (Exhibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 54.9 mph (Exhibit 25-19)
S = 51.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 710 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3950	0.92	Level	2	0	0.990	1.00	4336
Ramp	560	0.92	Level	2	0	0.990	1.00	615
UpStream								
DownStream	710	0.92	Level	2	0	0.990	1.00	779

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.623 using Equation (Exhibit 25-12)
V_{12} = 2934 pc/h
V_3 or V_{av34} 1402 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4336	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3721	Exhibit 25-14	6780	No
V_R	615	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2934	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 26.8 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.418 (Exhibit 25-19)
S_R = 50.1 mph (Exhibit 25-19)
S_0 = 59.9 mph (Exhibit 25-19)
S = 52.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1820 ft
V_D = 1310 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3800	0.92	Level	2	0	0.990	1.00	4172
Ramp	1040	0.92	Level	2	0	0.990	1.00	1142
UpStream								
DownStream	1310	0.93	Level	4	0	0.980	1.00	1437

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.603 using Equation (Exhibit 25-12)
V_{12} = 2970 pc/h
V_3 or V_{av34} 1202 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4172	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3030	Exhibit 25-14	6780	No
V_R	1142	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2970	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 23.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.466 (Exhibit 25-19)
S_R= 49.5 mph (Exhibit 25-19)
S_0= 60.6 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1820 ft
V_u = 1040 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2750	0.92	Level	2	0	0.990	1.00	3019
Ramp	1310	0.93	Level	4	0	0.980	1.00	1437
UpStream	1040	0.92	Level	2	0	0.990	1.00	1142
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1222.80 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1854 pc/h
V_3 or V_{av34} 1165 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4456	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3291	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 22.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.321 (Exibit 25-19)
S_R= 51.5 mph (Exhibit 25-19)
S_0= 53.6 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 6100 ft
V_D = 1040 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3150	0.92	Level	2	0	0.990	1.00	3458
Ramp	670	0.87	Level	1	0	0.995	1.00	774
UpStream								
DownStream	1040	0.92	Level	2	0	0.990	1.00	1142

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 4591.88 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2123 pc/h
V_3 or V_{av34} 1335 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4232	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2897	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.6 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.288 (Exibit 25-19)
S_R = 52.0 mph (Exhibit 25-19)
S_0 = 53.0 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2026 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	815	Weaving ratio, R	0.35
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	4200	0.86	2	0	1.5	1.2	0.990	1.00	4932
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	840	0.92	2	0	1.5	1.2	0.990	1.00	922
V_{w2}	450	0.92	2	0	1.5	1.2	0.990	1.00	494
V_w				1416	V_{nw}				4932
V									6348

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.39	0.74		
Weaving and non-weaving speeds, Si (mi/h)	34.22	41.38		

Number of lanes required for unconstrained operation, Nw 1.28
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.54
Weaving segment density, D (pc/mi/ln)	40.14
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6615
Capacity as a 15-minute flow rate, c (veh/h)	6550
Capacity as a full-hour volume, c_h (veh/h)	5725

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2026 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.19
Weaving seg length, L (ft)	810	Weaving ratio, R	0.10
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3320	0.92	2	0	1.5	1.2	0.990	1.00	3644
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	710	0.92	2	0	1.5	1.2	0.990	1.00	779
V_{w2}	80	0.92	2	0	1.5	1.2	0.990	1.00	87
V_w				866	V_{nw}				3644
V									4510

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.95	0.43		
Weaving and non-weaving speeds, Si (mi/h)	38.59	47.12		

Number of lanes required for unconstrained operation, Nw 1.12
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	45.20
Weaving segment density, D (pc/mi/ln)	24.94
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6781
Capacity as a 15-minute flow rate, c (veh/h)	6714
Capacity as a full-hour volume, c_h (veh/h)	6177

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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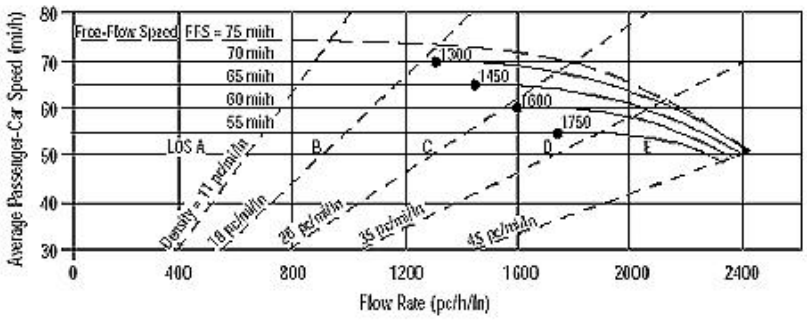
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2153*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*52.7*	mi/h	S	mi/h
D = v_p / S	*40.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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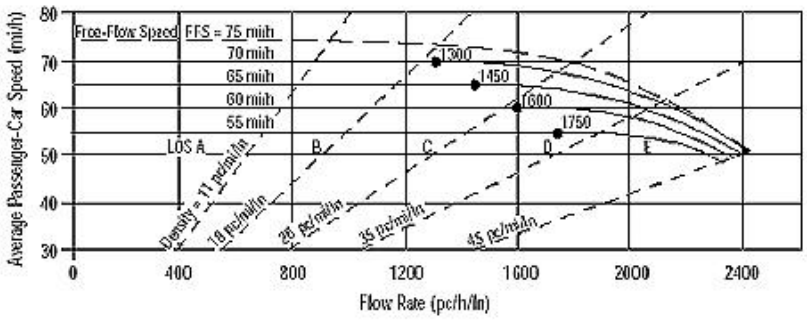

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1482*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*26.5*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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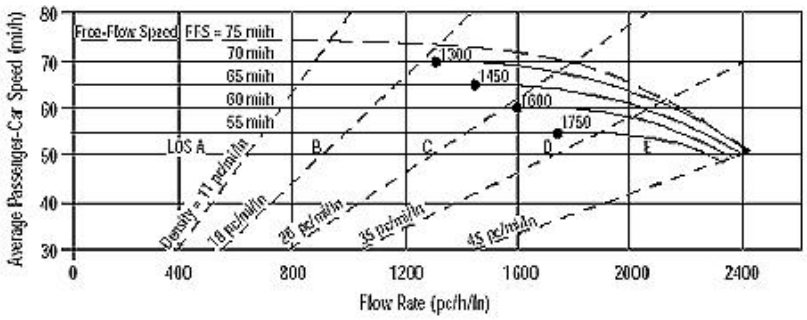

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1762*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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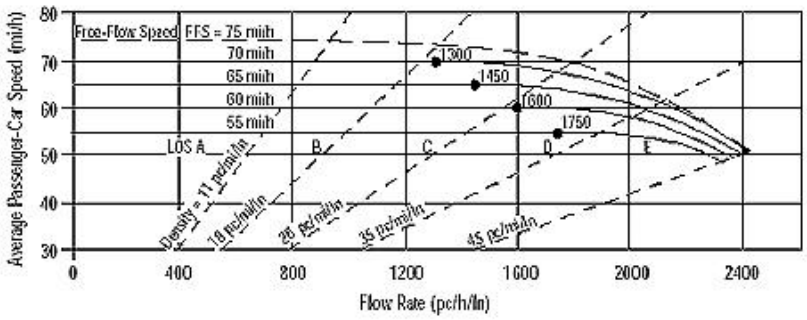

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1025*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*18.3*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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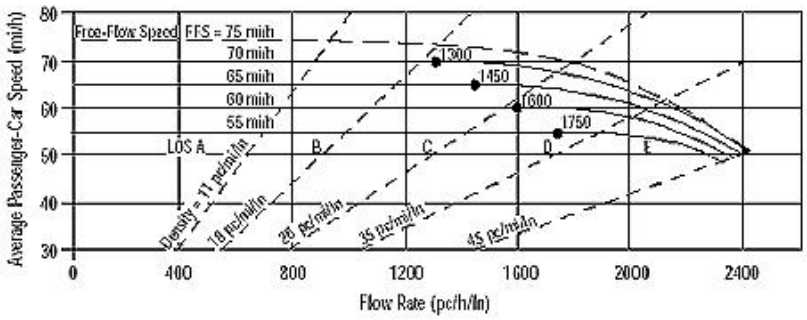

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5750*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2251*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*50.5*	mi/h	S	mi/h
D = v_p / S	*44.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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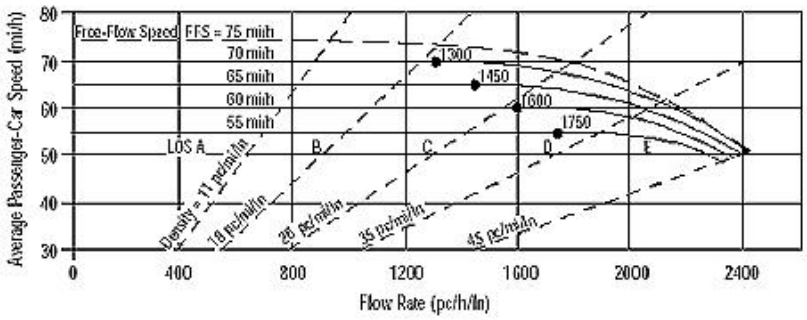

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3900*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1427*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*25.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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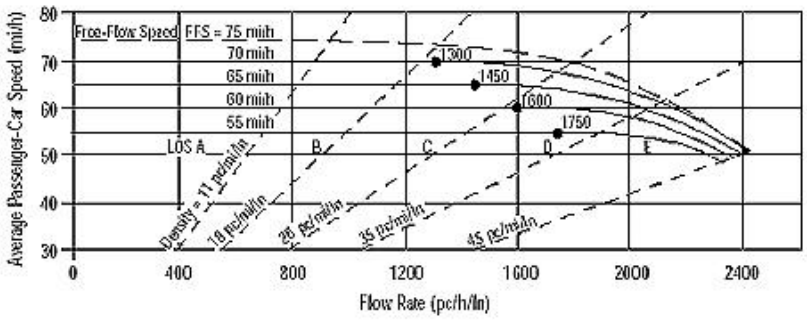

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6050*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1776*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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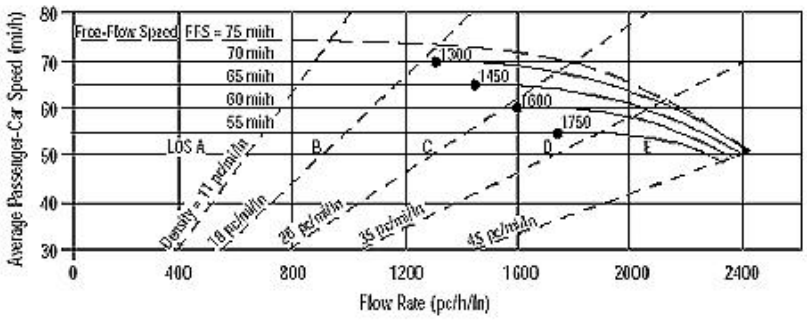

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		**Site Information**	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1029*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*18.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 880 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4700	0.86	Level	2	0	0.990	1.00	5520
Ramp	780	0.92	Level	2	0	0.990	1.00	856
UpStream	880	0.92	Level	2	0	0.990	1.00	966
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1431.66 (Equation 25-2 or 25-3)
P_{FM} = 0.580 using Equation (Exhibit 25-5)
V_{12} = 3203 pc/h
V_3 or V_{av34} 2317 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6376	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4059	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 31.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.479 (Exibit 25-19)
S_R= 49.3 mph (Exhibit 25-19)
S_0= 49.4 mph (Exhibit 25-19)
S = 49.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1850 ft
V_D = 980 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5500	0.86	Level	2	0	0.990	1.00	6459
Ramp	1000	0.86	Level	2	0	0.990	1.00	1174
UpStream								
DownStream	980	0.88	Level	1	0	0.995	1.00	1119

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.545 using Equation (Exhibit 25-12)
V_{12} = 4052 pc/h
V_3 or V_{av34} 2407 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6459	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5285	Exhibit 25-14	6780	No
V_R	1174	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4052	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 32.9 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.469 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 55.9 mph (Exhibit 25-19)
S = 51.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1850 ft
V_u = 1000 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4500	0.86	Level	2	0	0.990	1.00	5285
Ramp	980	0.88	Level	1	0	0.995	1.00	1119
UpStream	1000	0.92	Level	3	0	0.985	1.00	1103
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1641.90 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3246 pc/h
V_3 or V_{av34} 2039 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6404	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4365	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 30.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.523 (Exibit 25-19)
S_R= 48.7 mph (Exhibit 25-19)
S_0= 50.5 mph (Exhibit 25-19)
S = 49.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 5 NB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 7810 ft
V_u = 980 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5750	0.86	Level	2	0	0.990	1.00	6753
Ramp	440	0.92	Level	3	0	0.985	1.00	485
UpStream	980	0.88	Level	1	0	0.995	1.00	1119
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R = mph (Exhibit 25-19)

S_0 = mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 5906.29 (Equation 25-8 or 25-9)

P_{FD} = 0.569 using Equation (Exhibit 25-12)

V_{12} = 4051 pc/h

V_3 or V_{av34} 2702 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 4053 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6753	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	6268	Exhibit 25-14	6780	No
V_R	485	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4051	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 36.9 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.472 (Exhibit 25-19)

S_R = 49.4 mph (Exhibit 25-19)

S_0 = 54.8 mph (Exhibit 25-19)

S = 51.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 56.0 mph S_{FR} = 40.0 mph	L_{down} = 1300 ft
V_u = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = 750 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4050	0.92	Level	2	0	0.990	1.00	4446
Ramp	590	0.92	Level	2	0	0.990	1.00	648
UpStream								
DownStream	750	0.92	Level	2	0	0.990	1.00	823

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R = mph (Exhibit 25-19)

S_0 = mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.619 using Equation (Exhibit 25-12)

V_{12} = 2999 pc/h

V_3 or V_{av34} 1447 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4446	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3798	Exhibit 25-14	6780	No
V_R	648	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2999	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 27.3 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.421 (Exhibit 25-19)

S_R = 50.1 mph (Exhibit 25-19)

S_0 = 59.7 mph (Exhibit 25-19)

S = 52.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1820 ft
V_D = 1340 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3900	0.92	Level	2	0	0.990	1.00	4282
Ramp	1110	0.92	Level	2	0	0.990	1.00	1219
UpStream								
DownStream	1340	0.93	Level	4	0	0.980	1.00	1470

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.597 using Equation (Exhibit 25-12)
V_{12} = 3047 pc/h
V_3 or V_{av34} 1235 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4282	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3063	Exhibit 25-14	6780	No
V_R	1219	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3047	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 24.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.473 (Exhibit 25-19)
S_R = 49.4 mph (Exhibit 25-19)
S_0 = 60.5 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1820 ft
V_u = 1110 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2800	0.92	Level	2	0	0.990	1.00	3074
Ramp	1340	0.93	Level	4	0	0.980	1.00	1470
UpStream	1110	0.92	Level	2	0	0.990	1.00	1219
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1241.64 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1888 pc/h
V_3 or V_{av34} 1186 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4544	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3358	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 22.8 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.329 (Exibit 25-19)
S_R= 51.4 mph (Exhibit 25-19)
S_0= 53.5 mph (Exhibit 25-19)
S = 51.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/15/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Diamond

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 6100 ft
V_D = 1110 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3150	0.92	Level	2	0	0.990	1.00	3458
Ramp	730	0.87	Level	1	0	0.995	1.00	843
UpStream								
DownStream	1110	0.92	Level	2	0	0.990	1.00	1219

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 4901.49 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2123 pc/h
V_3 or V_{av34} 1335 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4301	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2966	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.293 (Exibit 25-19)
S_R= 51.9 mph (Exhibit 25-19)
S_0= 53.0 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2036 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	815	Weaving ratio, R	0.34
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	4240	0.86	2	0	1.5	1.2	0.990	1.00	4979
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	880	0.92	2	0	1.5	1.2	0.990	1.00	966
V_{w2}	460	0.92	2	0	1.5	1.2	0.990	1.00	504
V_w				1470	V_{nw}				4979
V									6449

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.43	0.77		
Weaving and non-weaving speeds, Si (mi/h)	33.95	40.97		

Number of lanes required for unconstrained operation, Nw 1.30
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.13
Weaving segment density, D (pc/mi/ln)	41.20
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6588
Capacity as a 15-minute flow rate, c (veh/h)	6523
Capacity as a full-hour volume, c_h (veh/h)	5704

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/15/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2036 Diamond

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.20
Weaving seg length, L (ft)	810	Weaving ratio, R	0.11
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3360	0.92	2	0	1.5	1.2	0.990	1.00	3688
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	750	0.92	2	0	1.5	1.2	0.990	1.00	823
V_{w2}	90	0.92	2	0	1.5	1.2	0.990	1.00	98
V_w				921	V_{nw}				3688
V									4609

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.98	0.46		
Weaving and non-weaving speeds, Si (mi/h)	38.18	46.59		

Number of lanes required for unconstrained operation, Nw 1.15
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	44.63
Weaving segment density, D (pc/mi/ln)	25.82
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6736
Capacity as a 15-minute flow rate, c (veh/h)	6669
Capacity as a full-hour volume, c_h (veh/h)	6135

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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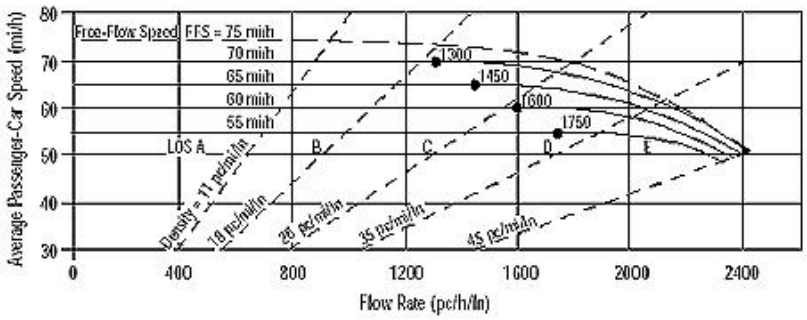
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1762*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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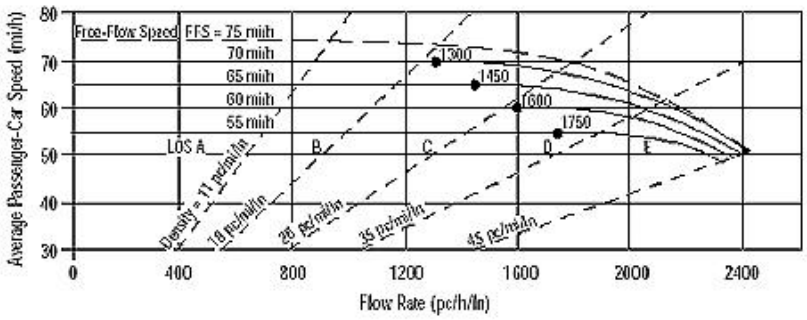

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1006*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*18.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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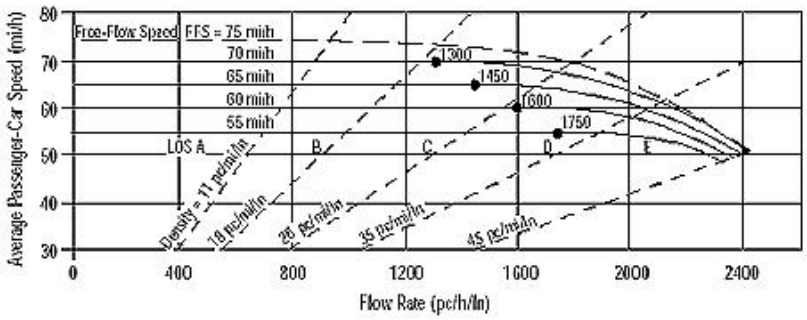

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5800*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2271*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S		mi/h	S	mi/h
D = v_p / S		pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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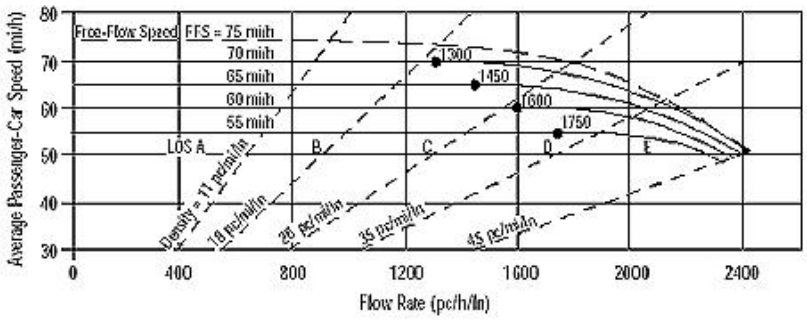
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/15/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Diamond*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3900*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1427*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*25.5*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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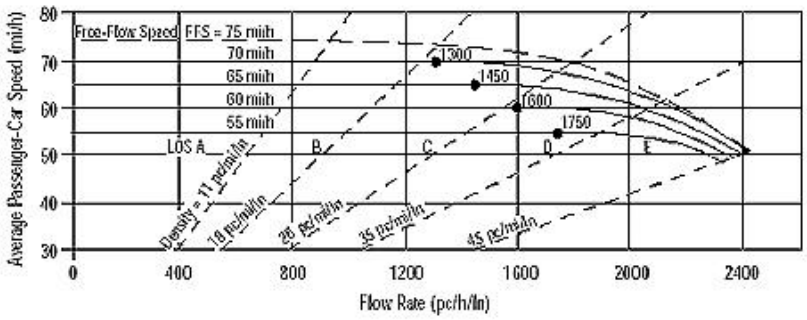
FLYOVER

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3250*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1189*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*21.2*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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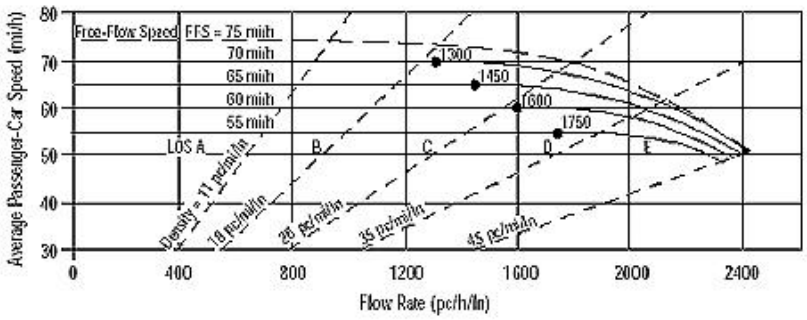
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5350*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1958*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*55.3*	mi/h	S	mi/h
D = v_p / S	*35.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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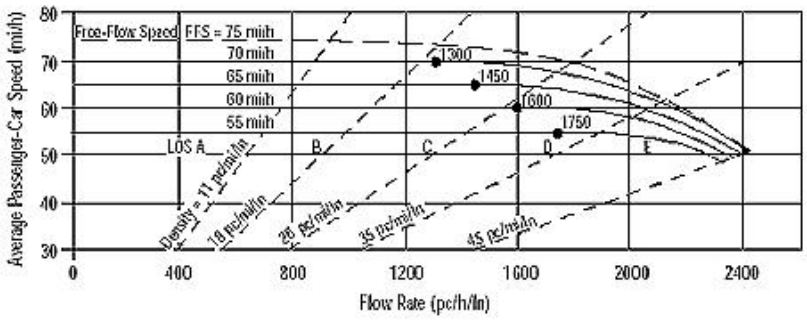

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*805*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*14.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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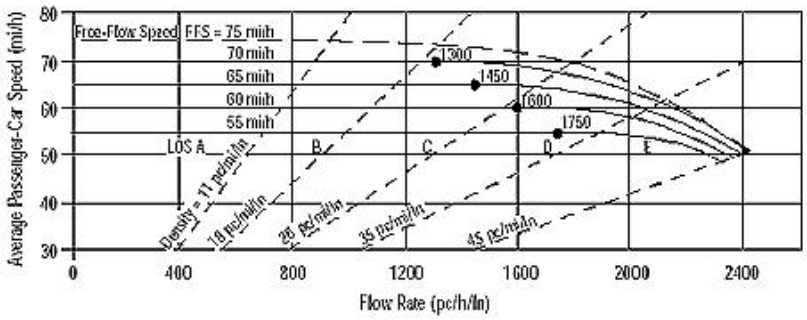

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*897*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*16.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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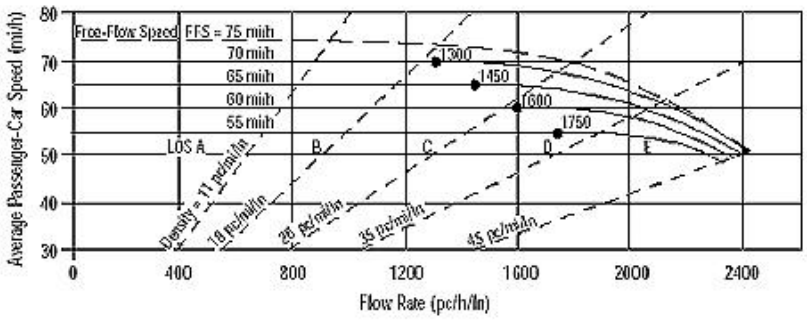

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1738*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*31.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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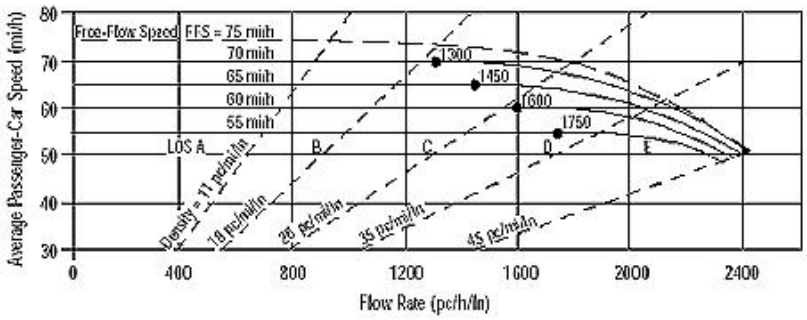

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2700*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*741*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*13.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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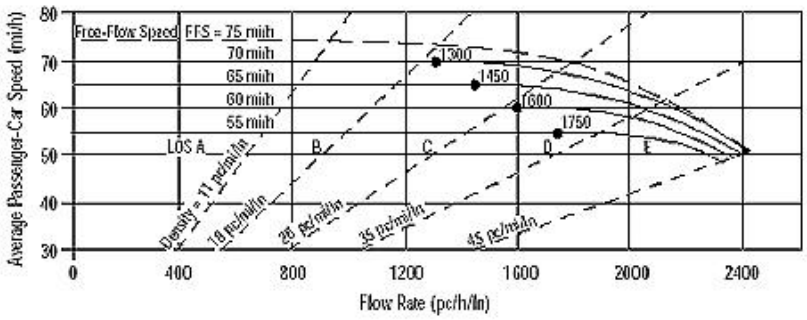
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5300*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1939*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*55.4*	mi/h	S		mi/h
D = v_p / S	*35.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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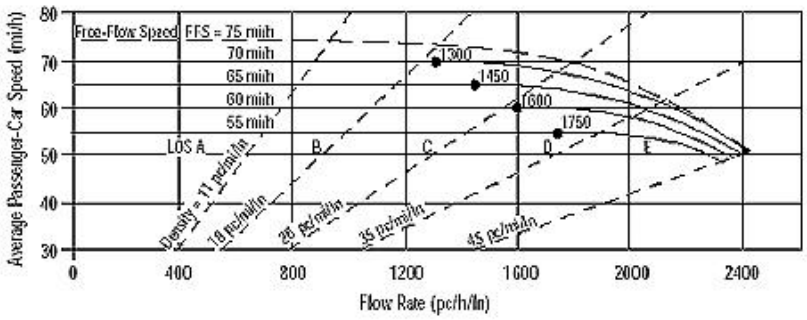
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2550*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*700*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*12.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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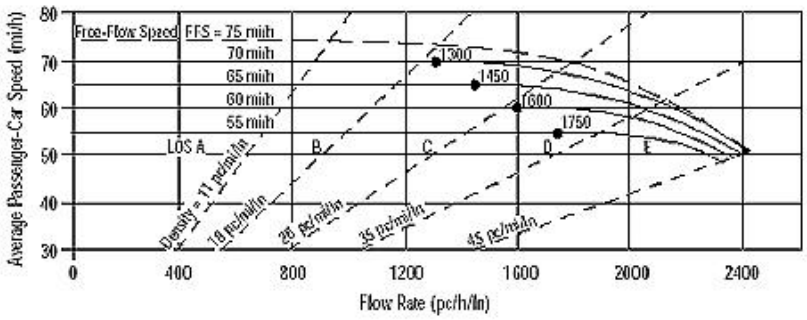
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1647*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*29.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 660 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2850	0.92	Level	2	0	0.990	1.00	3129
Ramp	390	0.92	Level	2	0	0.990	1.00	428
UpStream	660	0.92	Level	2	0	0.990	1.00	725
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 828.40 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1881 pc/h
V_3 or V_{av34} 1248 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3557	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2309	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 18.0 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.292 (Exibit 25-19)
S_R= 51.9 mph (Exhibit 25-19)
S_0= 53.3 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to ASR
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 2600 ft
V_D = 190 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3250	0.92	Level	2	0	0.990	1.00	3568
Ramp	800	0.82	Level	2	0	0.990	1.00	985
UpStream								
DownStream	190	0.82	Level	2	0	0.990	1.00	234

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 348.23 (Equation 25-8 or 25-9)
P_{FD} = 0.625 using Equation (Exhibit 25-12)
V_{12} = 2601 pc/h
V_3 or V_{av34} 967 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3568	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2583	Exhibit 25-14	6780	No
V_R	985	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2601	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 20.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.452 (Exhibit 25-19)
S_R = 49.7 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to Wolf
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2600 ft
V_u = 800 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2450	0.92	Level	2	0	0.990	1.00	2690
Ramp	190	0.82	Level	2	0	0.990	1.00	234
UpStream	800	0.82	Level	2	0	0.990	1.00	985
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.682 using Equation (Exhibit 25-12)
V_{12} = 1909 pc/h
V_3 or V_{av34} 781 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2690	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2456	Exhibit 25-14	6780	No
V_R	234	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1909	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 17.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.384 (Exhibit 25-19)
S_R= 50.6 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 53.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 340 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5350	0.92	Level	2	0	0.990	1.00	5873
Ramp	740	0.92	Level	2	0	0.990	1.00	812
UpStream								
DownStream	340	0.92	Level	2	0	0.990	1.00	373

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.576 using Equation (Exhibit 25-12)
V_{12} = 3726 pc/h
V_3 or V_{av34} 2147 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5873	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5061	Exhibit 25-14	6780	No
V_R	812	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3726	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.436 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 57.0 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1585 ft
V_D = 600 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5300	0.92	Level	2	0	0.990	1.00	5818
Ramp	560	0.92	Level	2	0	0.990	1.00	615
UpStream								
DownStream	600	0.93	Level	5	0	0.976	1.00	661

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.586 using Equation (Exhibit 25-12)
V_{12} = 3665 pc/h
V_3 or V_{av34} 2153 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5818	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5203	Exhibit 25-14	6780	No
V_R	615	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3665	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 26.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.418 (Exhibit 25-19)
S_R = 50.1 mph (Exhibit 25-19)
S_0 = 56.9 mph (Exhibit 25-19)
S = 52.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1585 ft
V_u = 560 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4750	0.92	Level	2	0	0.990	1.00	5215
Ramp	600	0.93	Level	5	0	0.976	1.00	661
UpStream	560	0.92	Level	2	0	0.990	1.00	615
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1531.12 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3204 pc/h
V_3 or V_{av34} 2011 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5876	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3865	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 27.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.402 (Exibit 25-19)
S_R= 50.4 mph (Exhibit 25-19)
S_0= 50.6 mph (Exhibit 25-19)
S = 50.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 4700 ft
V_D = 560 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4950	0.92	Level	2	0	0.990	1.00	5434
Ramp	340	0.93	Level	3	0	0.985	1.00	371
UpStream								
DownStream	560	0.92	Level	2	0	0.990	1.00	615

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2472.86 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3336 pc/h
V_3 or V_{av34} 2098 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	5805	Exhibit 25-7		No

Capacity Checks — Diverge Areas

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3707	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = 0.376 (Exibit 25-19)
S_R= 50.7 mph (Exhibit 25-19)
S_0= 50.2 mph (Exhibit 25-19)
S = 50.6 mph (Exhibit 25-14)

Speed Determination — Diverge Areas

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2016 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.27
Weaving seg length, L (ft)	815	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2550	0.92	2	0	1.5	1.2	0.990	1.00	2799
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	660	0.92	2	0	1.5	1.2	0.990	1.00	724
V_{w2}	300	0.92	2	0	1.5	1.2	0.990	1.00	329
V_w				1053	V_{nw}				2799
V									3852

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.94	0.46		
Weaving and non-weaving speeds, Si (mi/h)	38.74	46.59		

Number of lanes required for unconstrained operation, Nw 1.37
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	44.14
Weaving segment density, D (pc/mi/ln)	21.82
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6336
Capacity as a 15-minute flow rate, c (veh/h)	6273
Capacity as a full-hour volume, c_h (veh/h)	5771

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2016 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3860	0.92	2	0	1.5	1.2	0.990	1.00	4237
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	740	0.92	2	0	1.5	1.2	0.990	1.00	812
V_{w2}	340	0.92	2	0	1.5	1.2	0.990	1.00	373
V_w				1185	V_{nw}				4237
V									5422

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.19	0.60		
Weaving and non-weaving speeds, Si (mi/h)	35.98	43.76		

Number of lanes required for unconstrained operation, Nw 1.24
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.79
Weaving segment density, D (pc/mi/ln)	32.44
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6633
Capacity as a 15-minute flow rate, c (veh/h)	6567
Capacity as a full-hour volume, c_h (veh/h)	6042

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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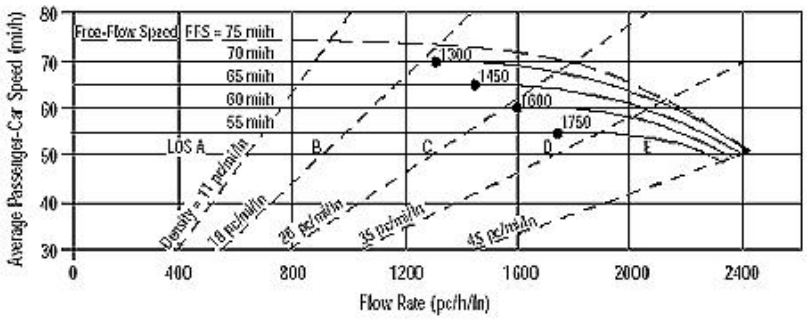
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3350*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1226*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*21.9*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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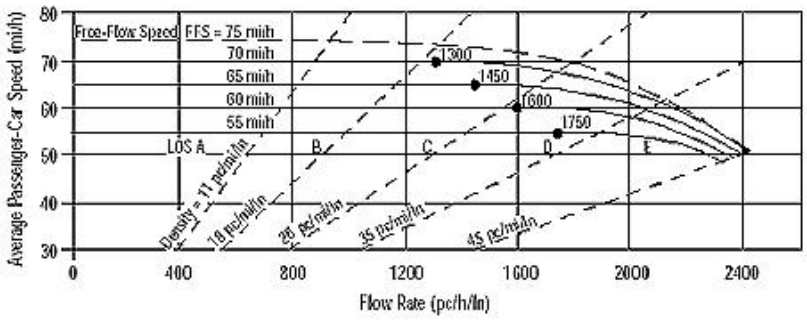
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5400*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1976*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.2*	mi/h	S	mi/h
D = v_p / S	*35.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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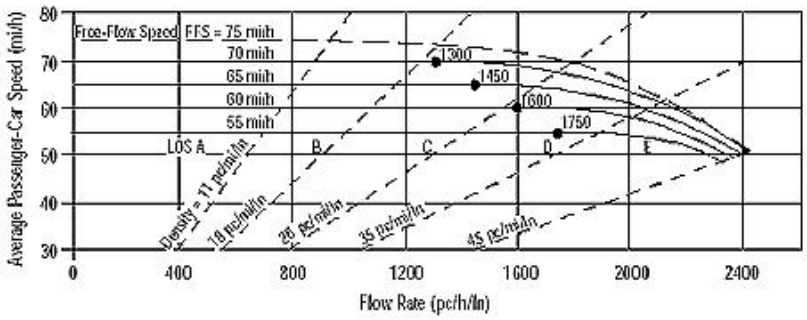

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*805*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*14.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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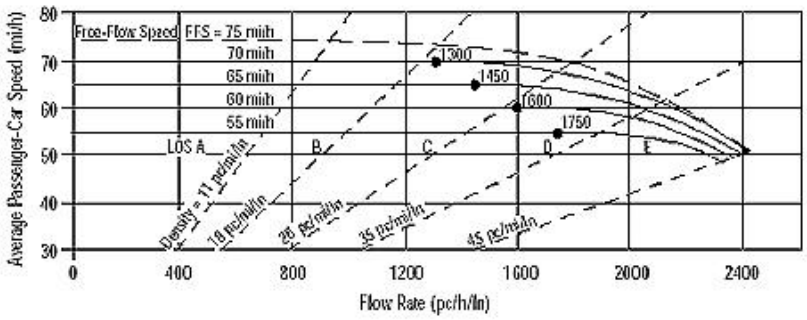

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2400*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*878*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*15.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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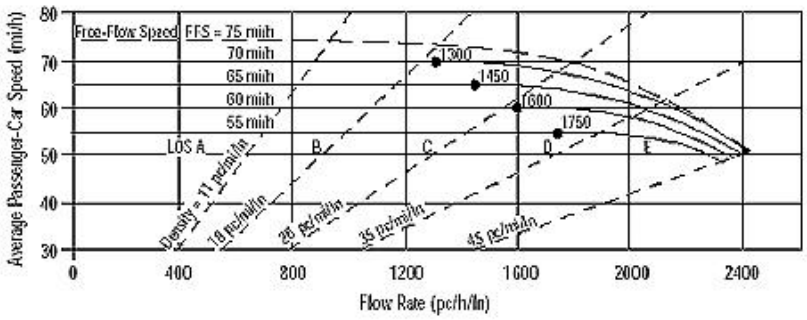

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4950*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1811*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.9*	mi/h	S	mi/h
D = v_p / S	*32.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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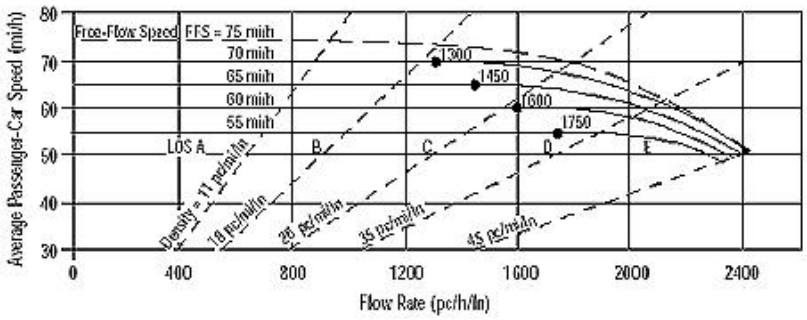

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2750*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*755*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*13.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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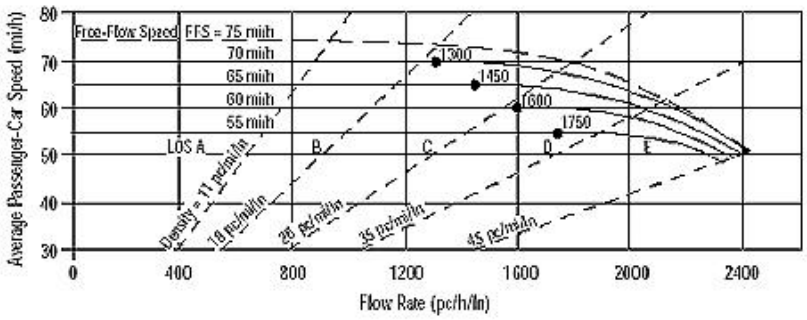

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2049*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*54.4*	mi/h	S	mi/h
D = v_p / S	*37.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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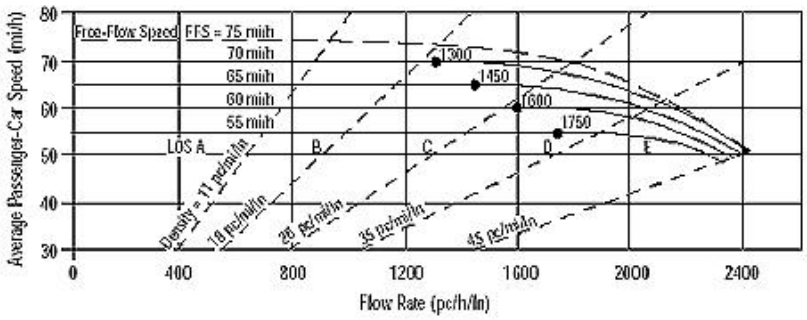

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2600*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*714*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*12.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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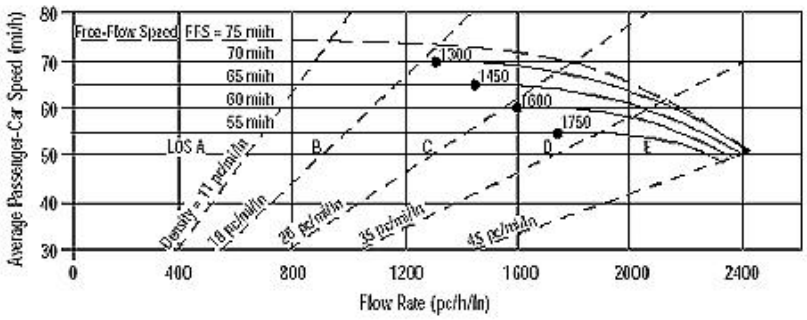
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1674*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*29.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 670 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2950	0.92	Level	2	0	0.990	1.00	3239
Ramp	400	0.92	Level	2	0	0.990	1.00	439
UpStream	670	0.92	Level	2	0	0.990	1.00	736
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 854.29 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 1948 pc/h
V_3 or V_{av34} 1291 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3678	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2387	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 18.6 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.295 (Exibit 25-19)
S_R= 51.9 mph (Exhibit 25-19)
S_0= 53.2 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to ASR
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 2600 ft
V_D = 190 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3350	0.92	Level	2	0	0.990	1.00	3678
Ramp	910	0.82	Level	2	0	0.990	1.00	1121
UpStream								
DownStream	190	0.82	Level	2	0	0.990	1.00	234

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 378.49 (Equation 25-8 or 25-9)
P_{FD} = 0.616 using Equation (Exhibit 25-12)
V_{12} = 2697 pc/h
V_3 or V_{av34} 981 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3678	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2557	Exhibit 25-14	6780	No
V_R	1121	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2697	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 21.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.464 (Exhibit 25-19)
S_R= 49.5 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to Wolf
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2600 ft
V_u = 910 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2400	0.92	Level	2	0	0.990	1.00	2635
Ramp	190	0.82	Level	2	0	0.990	1.00	234
UpStream	910	0.82	Level	2	0	0.990	1.00	1121
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.683 using Equation (Exhibit 25-12)
V_{12} = 1875 pc/h
V_3 or V_{av34} 760 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2635	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2401	Exhibit 25-14	6780	No
V_R	234	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1875	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 17.2 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.384 (Exhibit 25-19)
S_R = 50.6 mph (Exhibit 25-19)
S_0 = 61.4 mph (Exhibit 25-19)
S = 53.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 350 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5400	0.92	Level	2	0	0.990	1.00	5928
Ramp	760	0.92	Level	2	0	0.990	1.00	834
UpStream								
DownStream	350	0.92	Level	2	0	0.990	1.00	384

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.573 using Equation (Exhibit 25-12)
V_{12} = 3755 pc/h
V_3 or V_{av34} 2173 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5928	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5094	Exhibit 25-14	6780	No
V_R	834	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3755	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.438 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 56.9 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1585 ft
V_D = 650 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5600	0.92	Level	2	0	0.990	1.00	6148
Ramp	640	0.92	Level	2	0	0.990	1.00	703
UpStream								
DownStream	650	0.93	Level	5	0	0.976	1.00	716

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.574 using Equation (Exhibit 25-12)
V_{12} = 3828 pc/h
V_3 or V_{av34} 2320 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6148	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5445	Exhibit 25-14	6780	No
V_R	703	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3828	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 27.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.426 (Exhibit 25-19)
S_R= 50.0 mph (Exhibit 25-19)
S_0= 56.3 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1585 ft
V_u = 640 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4950	0.92	Level	2	0	0.990	1.00	5434
Ramp	650	0.93	Level	5	0	0.976	1.00	716
UpStream	640	0.92	Level	2	0	0.990	1.00	703
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1589.76 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3336 pc/h
V_3 or V_{av34} 2098 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6150	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4052	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 28.5 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.440 (Exibit 25-19)
S_R= 49.8 mph (Exhibit 25-19)
S_0= 50.2 mph (Exhibit 25-19)
S = 50.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 4700 ft
V_D = 640 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5200	0.92	Level	2	0	0.990	1.00	5709
Ramp	390	0.93	Level	3	0	0.985	1.00	426
UpStream								
DownStream	640	0.92	Level	2	0	0.990	1.00	703

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2826.70 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3505 pc/h
V_3 or V_{av34} 2204 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6135	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3931	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 27.8 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.416 (Exibit 25-19)
S_R= 50.2 mph (Exhibit 25-19)
S_0= 49.9 mph (Exhibit 25-19)
S = 50.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2026 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.27
Weaving seg length, L (ft)	815	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2640	0.92	2	0	1.5	1.2	0.990	1.00	2898
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	670	0.92	2	0	1.5	1.2	0.990	1.00	735
V_{w2}	310	0.92	2	0	1.5	1.2	0.990	1.00	340
V_w				1075	V_{nw}				2898
V									3973

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.96	0.47		
Weaving and non-weaving speeds, Si (mi/h)	38.45	46.27		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.86
Weaving segment density, D (pc/mi/ln)	22.65
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6352
Capacity as a 15-minute flow rate, c (veh/h)	6289
Capacity as a full-hour volume, c_h (veh/h)	5786

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2026 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3880	0.92	2	0	1.5	1.2	0.990	1.00	4259
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	770	0.92	2	0	1.5	1.2	0.990	1.00	845
V_{w2}	350	0.92	2	0	1.5	1.2	0.990	1.00	384
V_w				1229	V_{nw}				4259
V									5488

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.22	0.62		
Weaving and non-weaving speeds, Si (mi/h)	35.74	43.40		

Number of lanes required for unconstrained operation, Nw 1.26
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.41
Weaving segment density, D (pc/mi/ln)	33.13
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6603
Capacity as a 15-minute flow rate, c (veh/h)	6538
Capacity as a full-hour volume, c_h (veh/h)	6015

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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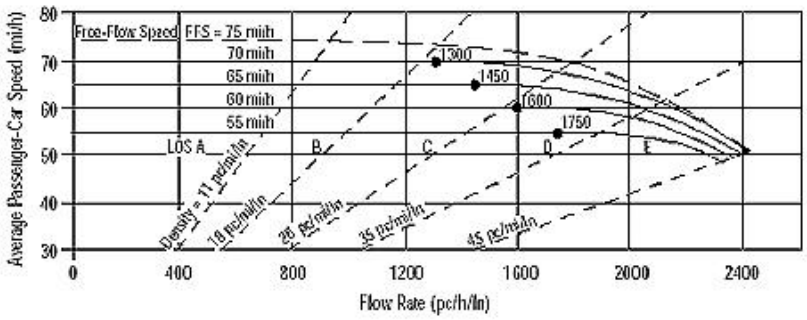
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1281*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*22.9*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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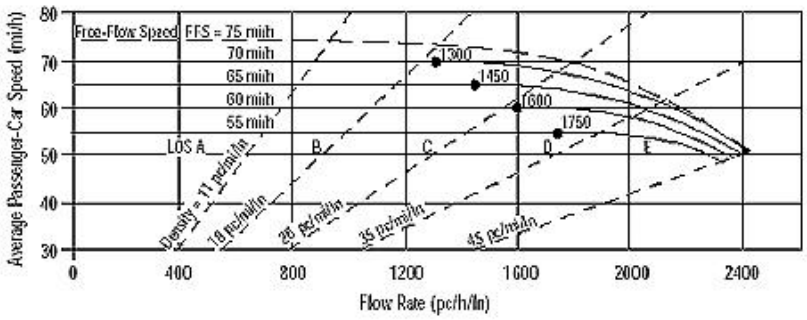

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1994*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*55.0*	mi/h	S		mi/h
D = v_p / S	*36.2*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*E*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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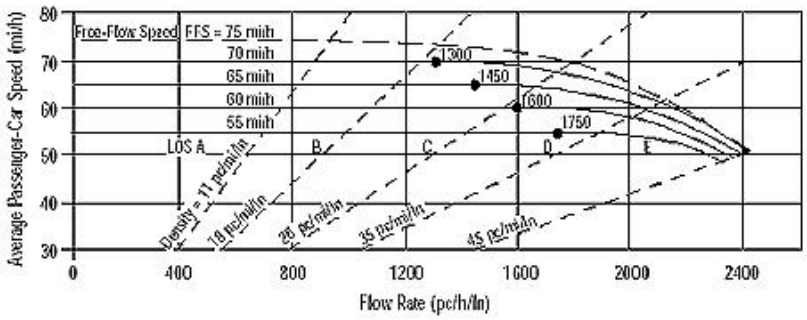

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2250*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*823*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*14.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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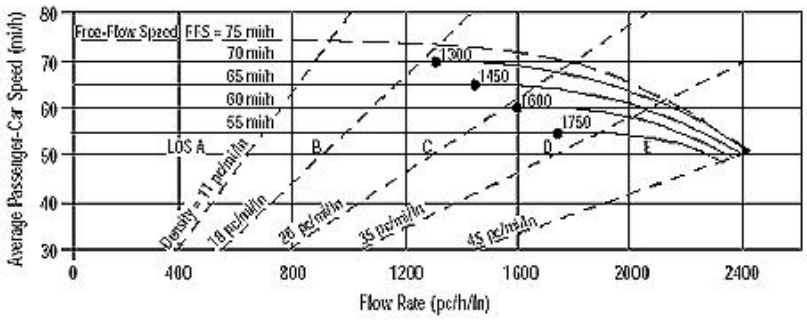

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*897*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*16.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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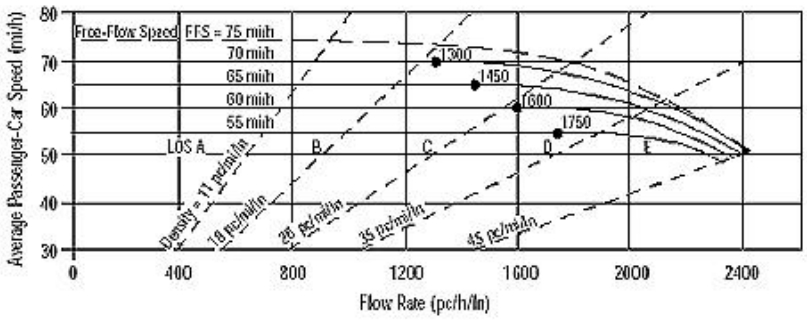
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1866*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*55.8*	mi/h	S	mi/h
D = v_p / S	*33.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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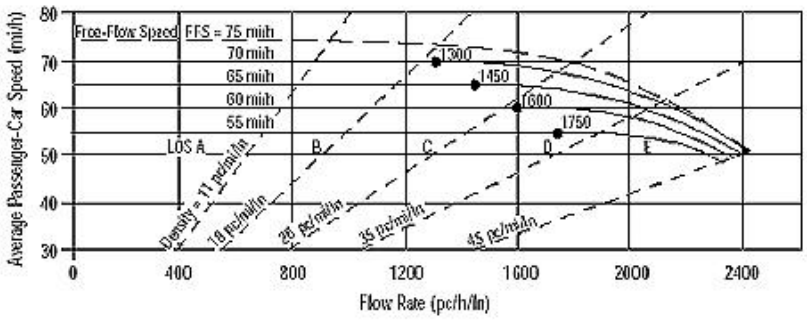

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*768*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*13.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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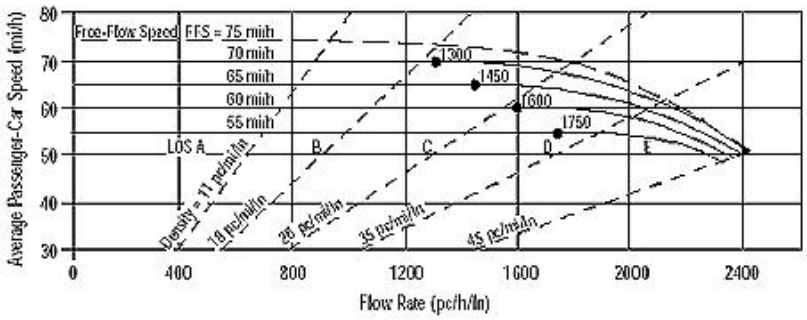

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2141*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*53.0*	mi/h	S	mi/h
D = v_p / S	*40.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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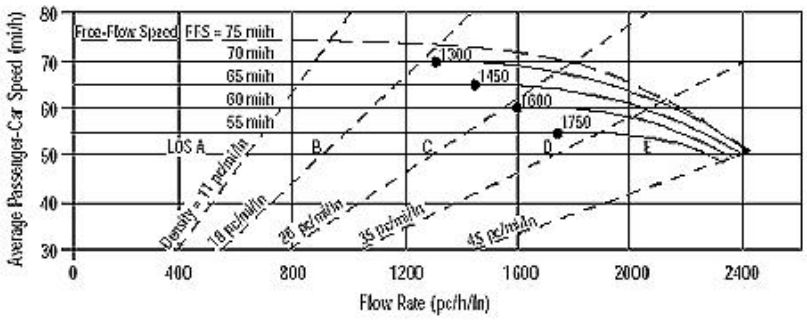

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		Site Information	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*727*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*13.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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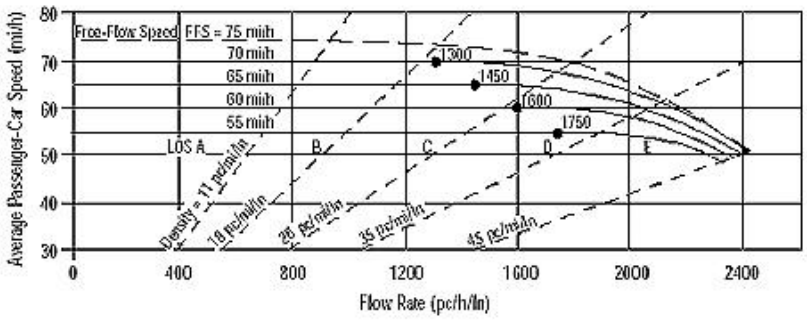
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6150*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1688*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 690 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3100	0.92	Level	2	0	0.990	1.00	3403
Ramp	420	0.92	Level	2	0	0.990	1.00	461
UpStream	690	0.92	Level	2	0	0.990	1.00	757
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 894.10 (Equation 25-2 or 25-3)
P_{FM} = 0.601 using Equation (Exhibit 25-5)
V_{12} = 2046 pc/h
V_3 or V_{av34} 1357 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3864	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2507	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.301 (Exibit 25-19)
S_R= 51.8 mph (Exhibit 25-19)
S_0= 52.9 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to ASR
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 2600 ft
V_D = 190 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3500	0.92	Level	2	0	0.990	1.00	3842
Ramp	1040	0.82	Level	2	0	0.990	1.00	1281
UpStream								
DownStream	190	0.82	Level	2	0	0.990	1.00	234

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 422.43 (Equation 25-8 or 25-9)
P_{FD} = 0.605 using Equation (Exhibit 25-12)
V_{12} = 2830 pc/h
V_3 or V_{av34} 1012 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3842	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2561	Exhibit 25-14	6780	No
V_R	1281	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2830	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 22.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.478 (Exhibit 25-19)
S_R= 49.3 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to Wolf
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2600 ft
V_u = 1040 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2450	0.92	Level	2	0	0.990	1.00	2690
Ramp	190	0.82	Level	2	0	0.990	1.00	234
UpStream	1040	0.82	Level	2	0	0.990	1.00	1281
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.682 using Equation (Exhibit 25-12)
V_{12} = 1909 pc/h
V_3 or V_{av34} 781 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2690	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	2456	Exhibit 25-14	6780	No
V_R	234	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1909	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 17.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.384 (Exhibit 25-19)
S_R= 50.6 mph (Exhibit 25-19)
S_0= 61.4 mph (Exhibit 25-19)
S = 53.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 360 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5450	0.92	Level	2	0	0.990	1.00	5983
Ramp	770	0.92	Level	2	0	0.990	1.00	845
UpStream								
DownStream	360	0.92	Level	2	0	0.990	1.00	395

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.572 using Equation (Exhibit 25-12)
V_{12} = 3782 pc/h
V_3 or V_{av34} 2201 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5983	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5138	Exhibit 25-14	6780	No
V_R	845	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3782	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 34.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.439 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 56.7 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1585 ft
V_D = 700 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5850	0.92	Level	2	0	0.990	1.00	6422
Ramp	730	0.92	Level	2	0	0.990	1.00	801
UpStream								
DownStream	700	0.93	Level	5	0	0.976	1.00	772

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.563 using Equation (Exhibit 25-12)
V_{12} = 3963 pc/h
V_3 or V_{av34} 2459 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6422	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5621	Exhibit 25-14	6780	No
V_R	801	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3963	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 28.9 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.435 (Exhibit 25-19)
S_R = 49.9 mph (Exhibit 25-19)
S_0 = 55.7 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1585 ft
V_u = 730 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5100	0.92	Level	2	0	0.990	1.00	5599
Ramp	700	0.93	Level	5	0	0.976	1.00	772
UpStream	730	0.92	Level	2	0	0.990	1.00	801
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1637.05 (Equation 25-2 or 25-3)
P_{FM} = 0.611 using Equation (Exhibit 25-5)
V_{12} = 3420 pc/h
V_3 or V_{av34} 2179 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6371	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4192	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 29.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.474 (Exibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 50.0 mph (Exhibit 25-19)
S = 49.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	AM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 4700 ft
V_D = 730 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5400	0.92	Level	2	0	0.990	1.00	5928
Ramp	470	0.93	Level	3	0	0.985	1.00	513
UpStream								
DownStream	730	0.92	Level	2	0	0.990	1.00	801

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 3220.75 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 3639 pc/h
V_3 or V_{av34} 2289 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6441	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4152	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 29.5 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.465 (Exibit 25-19)
S_R= 49.5 mph (Exhibit 25-19)
S_0= 49.6 mph (Exhibit 25-19)
S = 49.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2036 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.27
Weaving seg length, L (ft)	815	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	2780	0.92	2	0	1.5	1.2	0.990	1.00	3051
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	690	0.92	2	0	1.5	1.2	0.990	1.00	757
V_{w2}	320	0.92	2	0	1.5	1.2	0.990	1.00	351
V_w				1108	V_{nw}				3051
V									4159

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.00	0.49		
Weaving and non-weaving speeds, Si (mi/h)	38.02	45.81		

Number of lanes required for unconstrained operation, Nw 1.36
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.44
Weaving segment density, D (pc/mi/ln)	23.94
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6375
Capacity as a 15-minute flow rate, c (veh/h)	6312
Capacity as a full-hour volume, c_h (veh/h)	5807

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2036 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	810	Weaving ratio, R	0.31
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3910	0.92	2	0	1.5	1.2	0.990	1.00	4292
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	790	0.92	2	0	1.5	1.2	0.990	1.00	867
V_{w2}	360	0.92	2	0	1.5	1.2	0.990	1.00	395
V_w				1262	V_{nw}				4292
V									5554

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.24	0.64		
Weaving and non-weaving speeds, Si (mi/h)	35.54	43.11		

Number of lanes required for unconstrained operation, Nw 1.27
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	41.12
Weaving segment density, D (pc/mi/ln)	33.77
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6585
Capacity as a 15-minute flow rate, c (veh/h)	6520
Capacity as a full-hour volume, c_h (veh/h)	5998

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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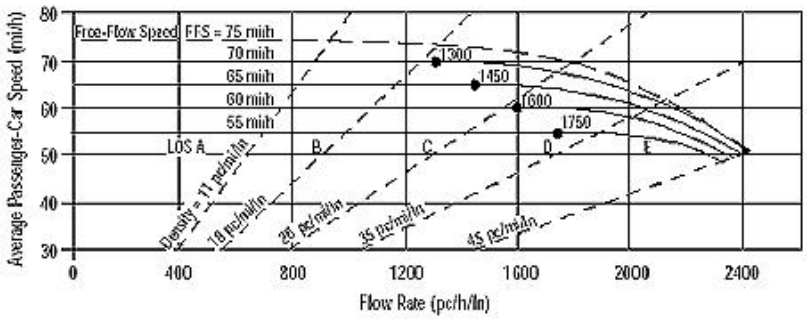
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2200*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*805*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*14.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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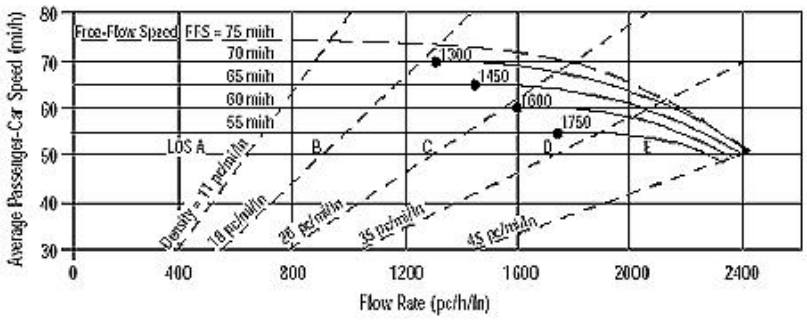
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2450*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*897*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*16.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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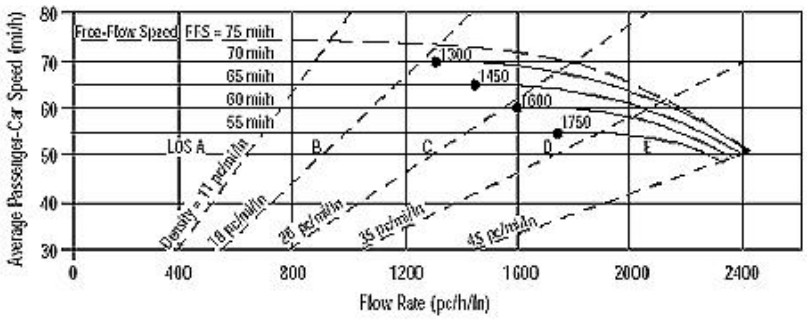

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5100*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1866*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.8*	mi/h	S	mi/h
D = v_p / S	*33.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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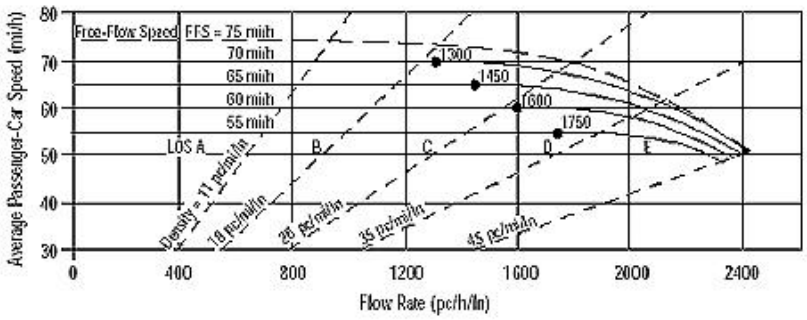

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5500*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2153*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*52.7*	mi/h	S	mi/h
D = v_p / S	*40.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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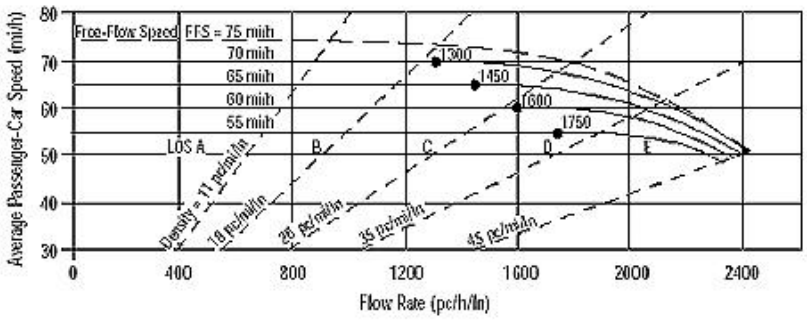

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3900*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1427*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*25.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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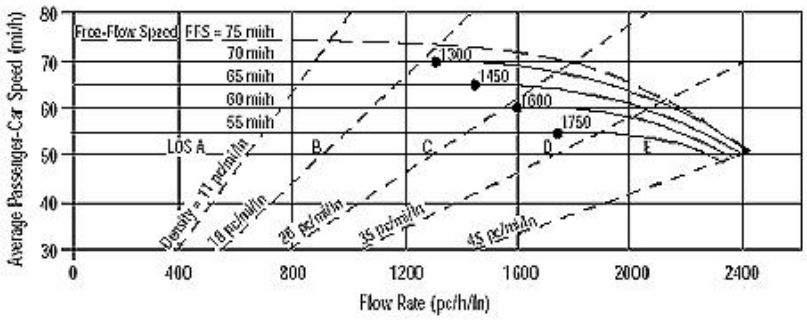
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4300*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1683*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*30.1*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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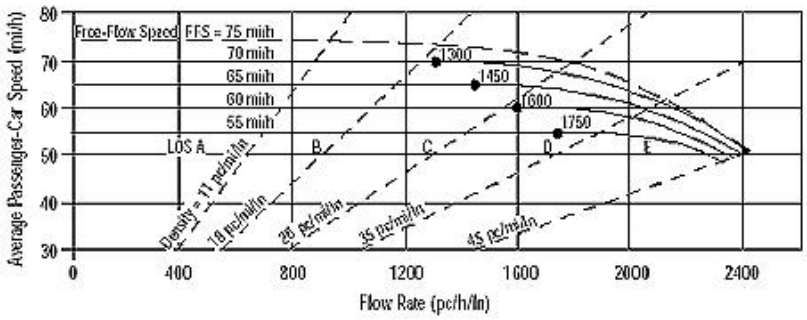
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4400*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1722*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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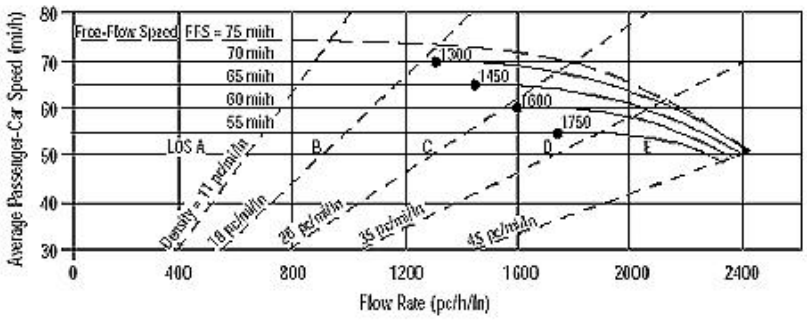
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2950*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1080*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*19.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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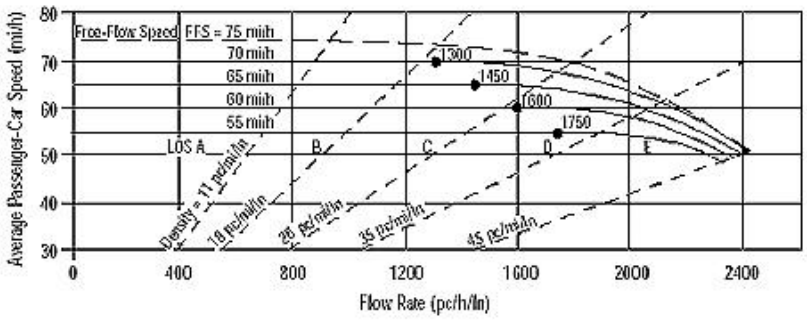
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5900*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1732*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*30.9*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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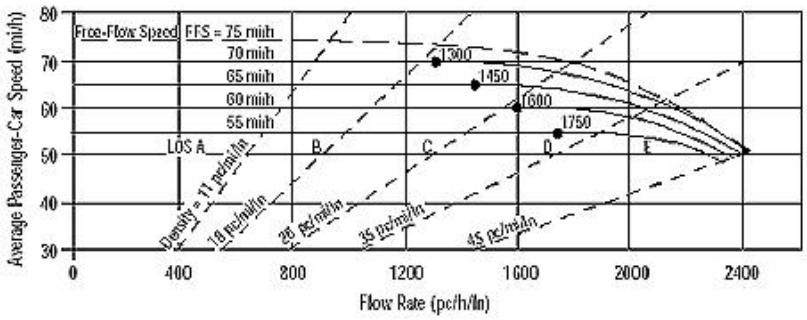
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1336*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*23.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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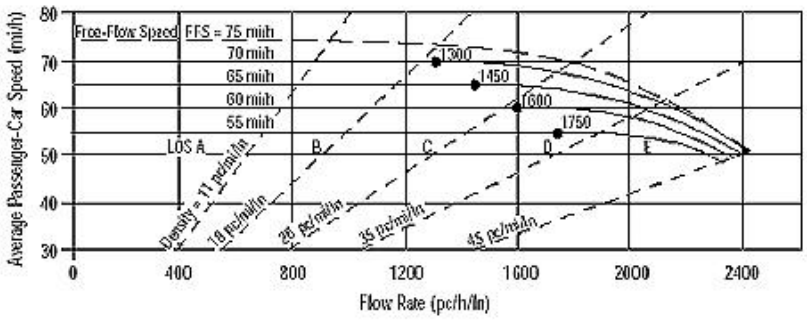
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6150*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1806*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*32.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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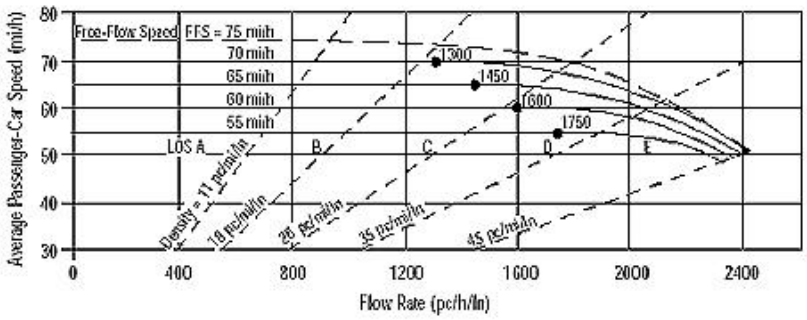
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2016 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3500*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*961*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 800 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4650	0.86	Level	2	0	0.990	1.00	5461
Ramp	870	0.92	Level	2	0	0.990	1.00	955
UpStream	800	0.92	Level	2	0	0.990	1.00	878
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1440.22 (Equation 25-2 or 25-3)
P_{FM} = 0.580 using Equation (Exhibit 25-5)
V_{12} = 3166 pc/h
V_3 or V_{av34} 2295 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6416	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4121	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 31.9 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.493 (Exibit 25-19)
S_R= 49.1 mph (Exhibit 25-19)
S_0= 49.5 mph (Exhibit 25-19)
S = 49.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to ASR
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 2600 ft
V_D = 110 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5500	0.86	Level	2	0	0.990	1.00	6459
Ramp	1090	0.86	Level	2	0	0.990	1.00	1280
UpStream								
DownStream	110	0.86	Level	1	0	0.995	1.00	129

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 274.30 (Equation 25-8 or 25-9)
P_{FD} = 0.540 using Equation (Exhibit 25-12)
V_{12} = 4075 pc/h
V_3 or V_{av34} 2384 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6459	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5179	Exhibit 25-14	6780	No
V_R	1280	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4075	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 33.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.478 (Exhibit 25-19)
S_R = 49.3 mph (Exhibit 25-19)
S_0 = 56.0 mph (Exhibit 25-19)
S = 51.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to Wolf
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2600 ft
V_u = 1090 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.86	Level	2	0	0.990	1.00	5167
Ramp	110	0.86	Level	2	0	0.990	1.00	129
UpStream	1090	0.86	Level	1	0	0.995	1.00	1274
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.625 using Equation (Exhibit 25-12)
V_{12} = 3277 pc/h
V_3 or V_{av34} 1890 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5167	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5038	Exhibit 25-14	6780	No
V_R	129	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3277	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 29.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.375 (Exhibit 25-19)
S_R= 50.8 mph (Exhibit 25-19)
S_0= 58.0 mph (Exhibit 25-19)
S = 53.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 800 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3900	0.92	Level	2	0	0.990	1.00	4282
Ramp	430	0.92	Level	2	0	0.990	1.00	472
UpStream								
DownStream	800	0.92	Level	2	0	0.990	1.00	878

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.631 using Equation (Exhibit 25-12)
V_{12} = 2877 pc/h
V_3 or V_{av34} 1405 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4282	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3810	Exhibit 25-14	6780	No
V_R	472	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2877	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 26.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.405 (Exhibit 25-19)
S_R = 50.3 mph (Exhibit 25-19)
S_0 = 59.9 mph (Exhibit 25-19)
S = 53.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1585 ft
V_D = 990 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3650	0.92	Level	2	0	0.990	1.00	4007
Ramp	720	0.92	Level	2	0	0.990	1.00	790
UpStream								
DownStream	990	0.93	Level	4	0	0.980	1.00	1086

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.623 using Equation (Exhibit 25-12)
V_{12} = 2796 pc/h
V_3 or V_{av34} 1211 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4007	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3217	Exhibit 25-14	6780	No
V_R	790	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2796	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 18.8 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.434 (Exhibit 25-19)
S_R= 49.9 mph (Exhibit 25-19)
S_0= 60.6 mph (Exhibit 25-19)
S = 52.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1585 ft
V_u = 720 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2950	0.92	Level	2	0	0.990	1.00	3239
Ramp	990	0.93	Level	4	0	0.980	1.00	1086
UpStream	720	0.92	Level	2	0	0.990	1.00	790
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1199.21 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 1990 pc/h
V_3 or V_{av34} 1249 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4325	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3076	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 20.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.300 (Exibit 25-19)
S_R= 51.8 mph (Exhibit 25-19)
S_0= 53.3 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2016 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 4700 ft
V_D = 720 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3050	0.92	Level	2	0	0.990	1.00	3348
Ramp	610	0.87	Level	1	0	0.995	1.00	705
UpStream								
DownStream	720	0.92	Level	2	0	0.990	1.00	790

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = 3176.52 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2055 pc/h
V_3 or V_{av34} 1293 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks — Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	4053	Exhibit 25-7		No

Capacity Checks — Diverge Areas

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2760	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 18.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination — Merge Areas

M_S = 0.279 (Exibit 25-19)
S_R= 52.1 mph (Exhibit 25-19)
S_0= 53.1 mph (Exhibit 25-19)
S = 52.4 mph (Exhibit 25-14)

Speed Determination — Diverge Areas

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2016 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	815	Weaving ratio, R	0.36
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	4200	0.86	2	0	1.5	1.2	0.990	1.00	4932
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	800	0.92	2	0	1.5	1.2	0.990	1.00	878
V_{w2}	450	0.92	2	0	1.5	1.2	0.990	1.00	494
V_w				1372	V_{nw}				4932
V									6304

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.37	0.72		
Weaving and non-weaving speeds, Si (mi/h)	34.40	41.69		

Number of lanes required for unconstrained operation, Nw 1.26
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.85
Weaving segment density, D (pc/mi/ln)	39.55
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6645
Capacity as a 15-minute flow rate, c (veh/h)	6579
Capacity as a full-hour volume, c_h (veh/h)	5748

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2016 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	810	Weaving ratio, R	0.15
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3310	0.92	2	0	1.5	1.2	0.990	1.00	3633
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	800	0.92	2	0	1.5	1.2	0.990	1.00	878
V_{w2}	140	0.92	2	0	1.5	1.2	0.990	1.00	153
V_w				1031	V_{nw}				3633
V									4664

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.03	0.50		
Weaving and non-weaving speeds, Si (mi/h)	37.61	45.73		

Number of lanes required for unconstrained operation, Nw 1.22
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.64
Weaving segment density, D (pc/mi/ln)	26.72
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6619
Capacity as a 15-minute flow rate, c (veh/h)	6553
Capacity as a full-hour volume, c_h (veh/h)	6029

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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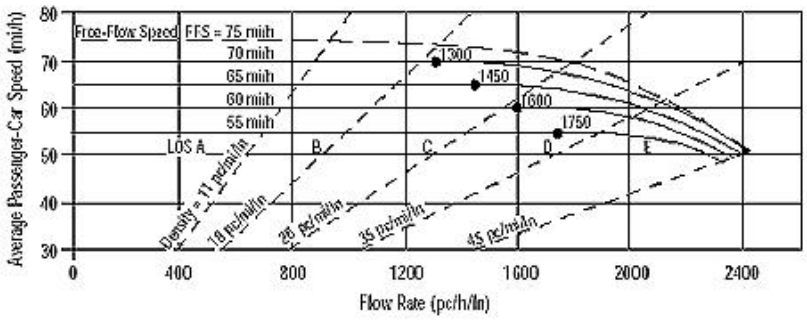
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5600*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2192*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*51.9*	mi/h	S	mi/h
D = v_p / S	*42.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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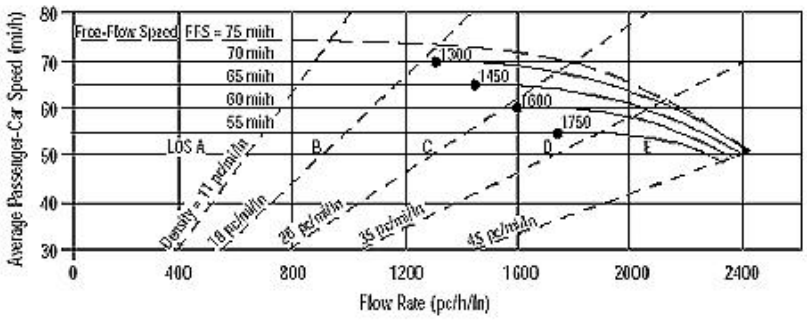

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1464*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*26.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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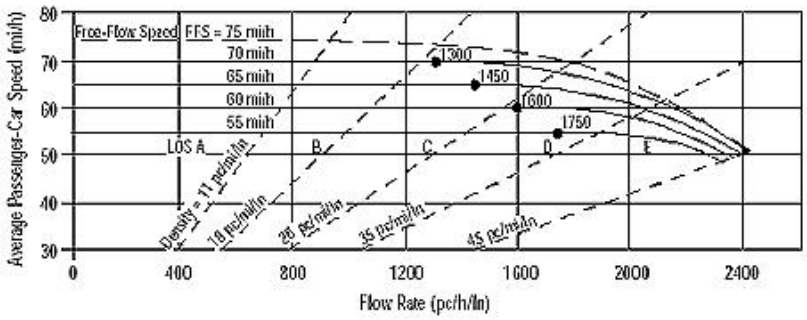
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4350*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1703*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*30.4*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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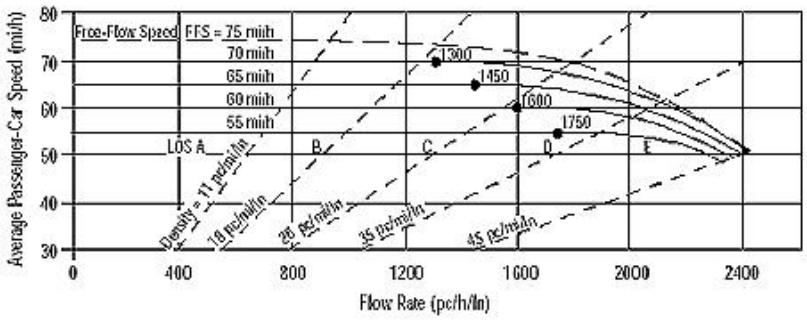
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4450*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1742*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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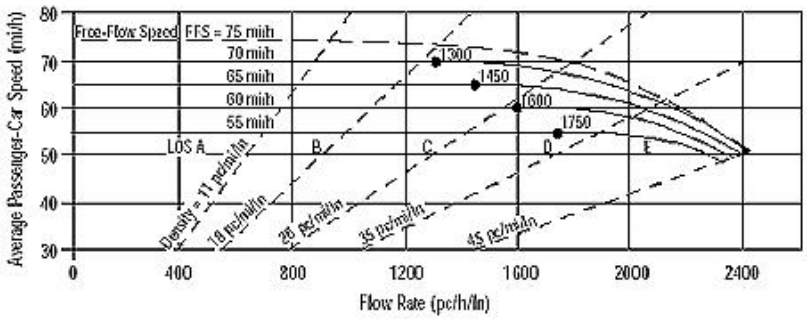

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1116*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*19.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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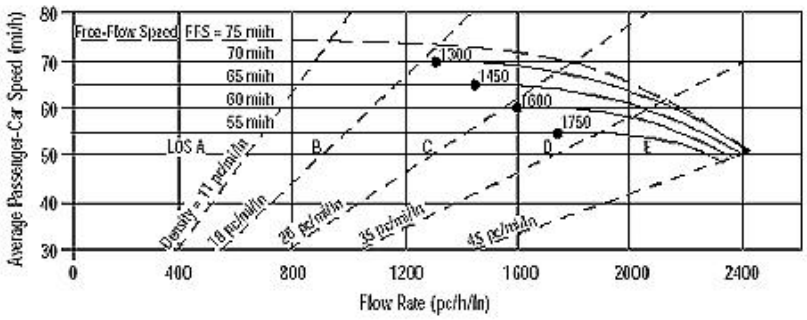
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5950*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1747*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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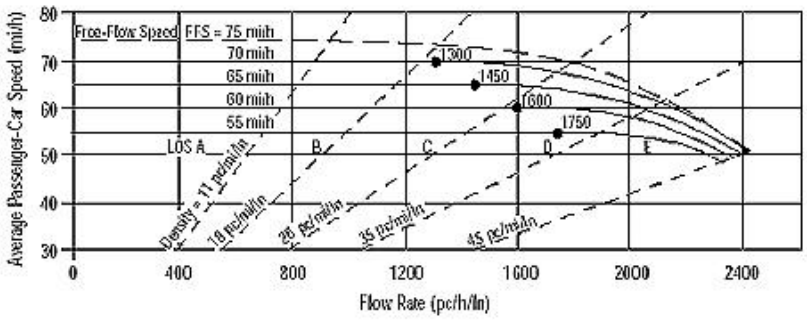
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1391*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*24.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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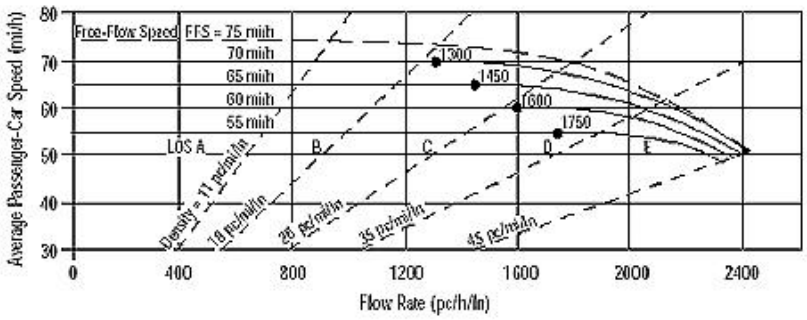
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6175*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1813*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.9*	mi/h	S	mi/h
D = v_p / S	*32.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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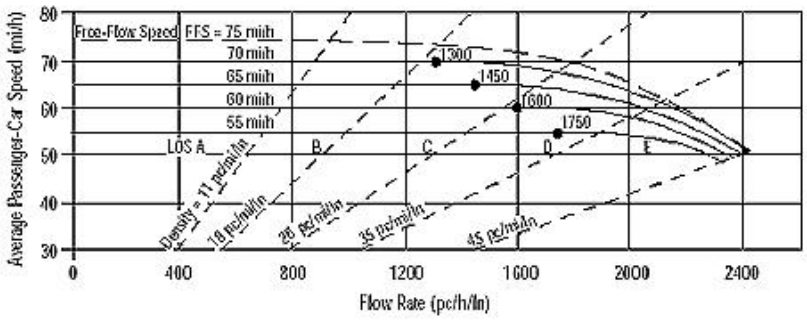
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2026 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3650*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1002*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*17.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 840 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4750	0.86	Level	2	0	0.990	1.00	5578
Ramp	870	0.92	Level	2	0	0.990	1.00	955
UpStream	840	0.92	Level	2	0	0.990	1.00	922
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1465.26 (Equation 25-2 or 25-3)
P_{FM} = 0.578 using Equation (Exhibit 25-5)
V_{12} = 3225 pc/h
V_3 or V_{av34} 2353 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6533	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4180	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 32.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.508 (Exibit 25-19)
S_R= 48.9 mph (Exhibit 25-19)
S_0= 49.2 mph (Exhibit 25-19)
S = 49.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to ASR
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 2600 ft
V_D = 120 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5600	0.86	Level	2	0	0.990	1.00	6577
Ramp	1170	0.86	Level	2	0	0.990	1.00	1374
UpStream								
DownStream	120	0.86	Level	1	0	0.995	1.00	140

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 324.22 (Equation 25-8 or 25-9)
P_{FD} = 0.532 using Equation (Exhibit 25-12)
V_{12} = 4144 pc/h
V_3 or V_{av34} 2433 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6577	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5203	Exhibit 25-14	6780	No
V_R	1374	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4144	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 33.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.487 (Exhibit 25-19)
S_R= 49.2 mph (Exhibit 25-19)
S_0= 55.8 mph (Exhibit 25-19)
S = 51.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to Wolf
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2600 ft
V_u = 1170 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4450	0.86	Level	2	0	0.990	1.00	5226
Ramp	120	0.86	Level	2	0	0.990	1.00	141
UpStream	1170	0.86	Level	1	0	0.995	1.00	1367
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.623 using Equation (Exhibit 25-12)
V_{12} = 3308 pc/h
V_3 or V_{av34} 1918 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5226	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5085	Exhibit 25-14	6780	No
V_R	141	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3308	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 29.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.376 (Exhibit 25-19)
S_R= 50.7 mph (Exhibit 25-19)
S_0= 57.9 mph (Exhibit 25-19)
S = 53.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 840 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4000	0.92	Level	2	0	0.990	1.00	4391
Ramp	450	0.92	Level	2	0	0.990	1.00	494
UpStream								
DownStream	840	0.92	Level	2	0	0.990	1.00	922

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.628 using Equation (Exhibit 25-12)
V_{12} = 2939 pc/h
V_3 or V_{av34} 1452 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4391	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3897	Exhibit 25-14	6780	No
V_R	494	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2939	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 26.8 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.407 (Exhibit 25-19)
S_R= 50.3 mph (Exhibit 25-19)
S_0= 59.7 mph (Exhibit 25-19)
S = 53.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1585 ft
V_D = 1010 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3800	0.92	Level	2	0	0.990	1.00	4172
Ramp	770	0.92	Level	2	0	0.990	1.00	845
UpStream								
DownStream	1010	0.93	Level	4	0	0.980	1.00	1108

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.617 using Equation (Exhibit 25-12)
V_{12} = 2897 pc/h
V_3 or V_{av34} 1275 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4172	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3327	Exhibit 25-14	6780	No
V_R	845	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2897	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 19.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.439 (Exhibit 25-19)
S_R= 49.9 mph (Exhibit 25-19)
S_0= 60.4 mph (Exhibit 25-19)
S = 52.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1585 ft
V_u = 770 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3050	0.92	Level	2	0	0.990	1.00	3348
Ramp	1010	0.93	Level	4	0	0.980	1.00	1108
UpStream	770	0.92	Level	2	0	0.990	1.00	845
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1227.24 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2057 pc/h
V_3 or V_{av34} 1291 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4456	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3165	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 21.4 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.308 (Exibit 25-19)
S_R= 51.7 mph (Exhibit 25-19)
S_0= 53.2 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2026 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 4700 ft
V_D = 770 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3150	0.92	Level	2	0	0.990	1.00	3458
Ramp	640	0.87	Level	1	0	0.995	1.00	739
UpStream								
DownStream	770	0.92	Level	2	0	0.990	1.00	845

Merge Areas | Diverge Areas

Estimation of v_{12} (Merge Areas)

$V_{12} = V_F (P_{FM})$
L_{EQ} = 3397.67 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2123 pc/h
V_3 or V_{av34} 1335 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} (Diverge Areas)

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks (Merge Areas)

	Actual	Capacity		LOS F?
V_{FO}	4197	Exhibit 25-7		No

Capacity Checks (Diverge Areas)

	Actual	Capacity		
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2862	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F) (Merge Areas)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 19.3 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Level of Service Determination (if not F) (Diverge Areas)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination (Merge Areas)

M_S = 0.285 (Exibit 25-19)
S_R= 52.0 mph (Exhibit 25-19)
S_0= 53.0 mph (Exhibit 25-19)
S = 52.3 mph (Exhibit 25-14)

Speed Determination (Diverge Areas)

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2026 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.22
Weaving seg length, L (ft)	815	Weaving ratio, R	0.36
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	4280	0.86	2	0	1.5	1.2	0.990	1.00	5026
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	840	0.92	2	0	1.5	1.2	0.990	1.00	922
V_{w2}	470	0.92	2	0	1.5	1.2	0.990	1.00	515
V_w				1437	V_{nw}				5026
V									6463

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.42	0.76		
Weaving and non-weaving speeds, Si (mi/h)	34.04	41.15		

Number of lanes required for unconstrained operation, Nw 1.28
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	39.32
Weaving segment density, D (pc/mi/ln)	41.09
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6619
Capacity as a 15-minute flow rate, c (veh/h)	6553
Capacity as a full-hour volume, c_h (veh/h)	5728

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2026 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	810	Weaving ratio, R	0.14
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3210	0.92	2	0	1.5	1.2	0.990	1.00	3524
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	840	0.92	2	0	1.5	1.2	0.990	1.00	922
V_{w2}	140	0.92	2	0	1.5	1.2	0.990	1.00	153
V_w				1075	V_{nw}				3524
V									4599

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.04	0.51		
Weaving and non-weaving speeds, Si (mi/h)	37.50	45.49		

Number of lanes required for unconstrained operation, Nw 1.26
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	43.33
Weaving segment density, D (pc/mi/ln)	26.53
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	6549
Capacity as a 15-minute flow rate, c (veh/h)	6484
Capacity as a full-hour volume, c_h (veh/h)	5965

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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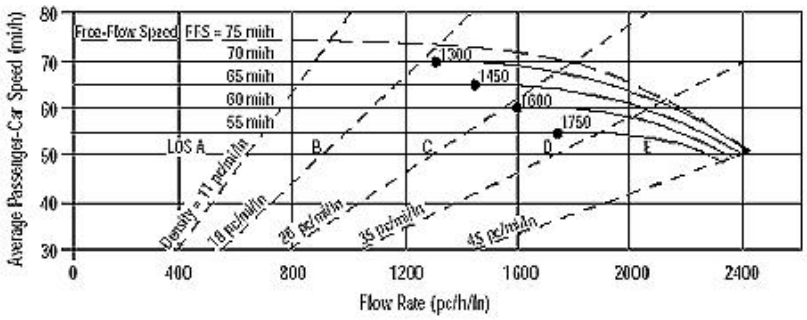
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 2 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5650*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2212*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*51.5*	mi/h	S	mi/h
D = v_p / S	*43.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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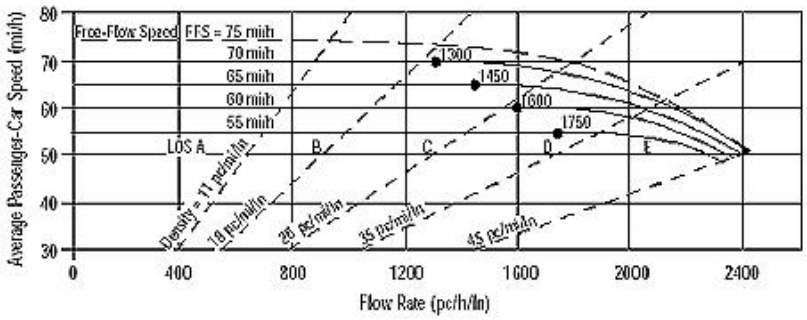

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 2*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4150*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1519*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*27.1*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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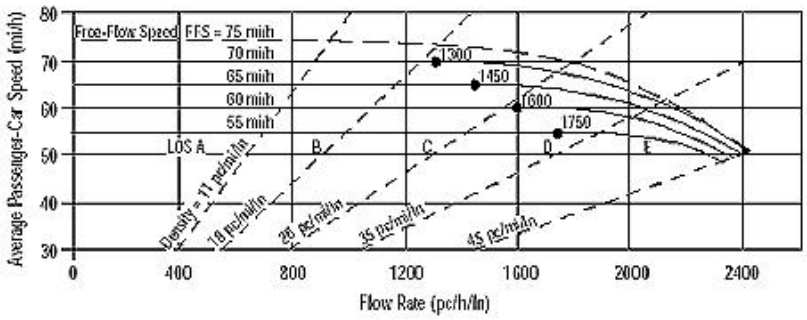

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4300*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1683*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*30.1*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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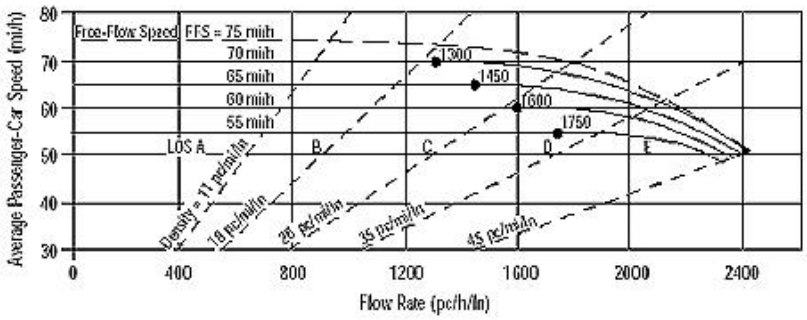

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4400*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1722*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*30.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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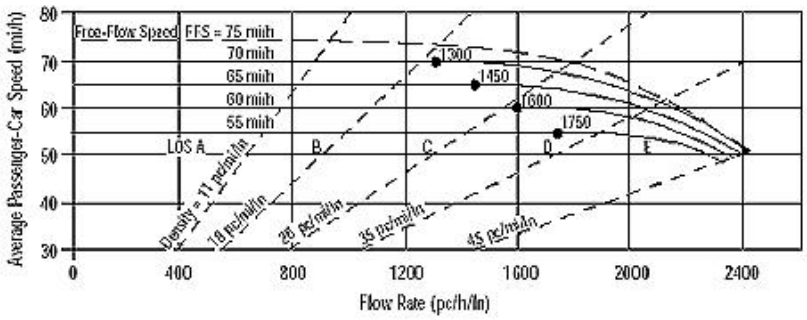

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3050*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1116*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*19.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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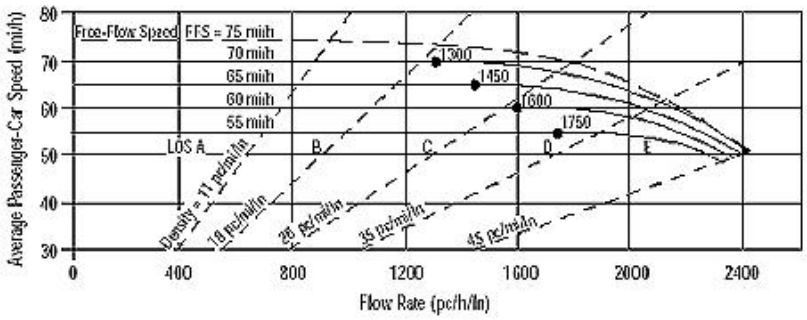

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 to Exit 5*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5950*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1747*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*31.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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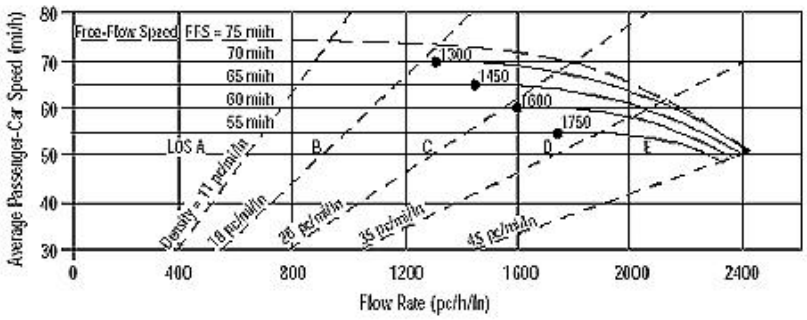

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3900*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1427*	pc/h/ln	Design LOS v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	 pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*25.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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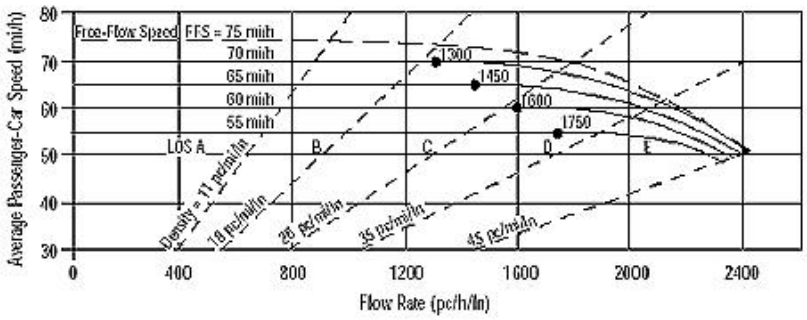
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 6*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6200*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1820*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.9*	mi/h	S	mi/h
D = v_p / S	*32.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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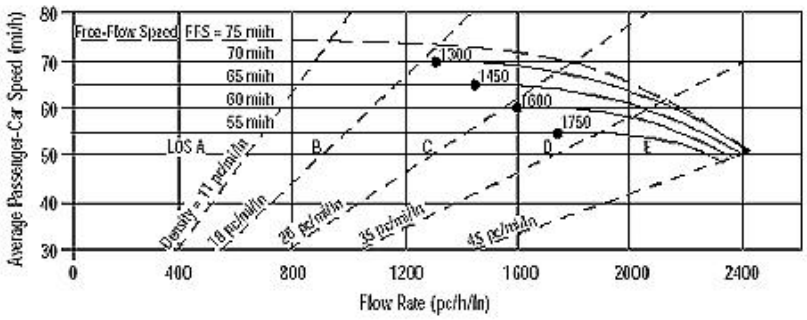
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*CLD*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 6 to Exit 5*
Date Performed	*07/30/13*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2036 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3800*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1043*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.0*	mi/h	S	mi/h
D = v_p / S	*18.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 2W On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1100 ft
V_u = 880 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4750	0.86	Level	2	0	0.990	1.00	5578
Ramp	880	0.92	Level	2	0	0.990	1.00	966
UpStream	880	0.92	Level	2	0	0.990	1.00	966
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1467.62 (Equation 25-2 or 25-3)
P_{FM} = 0.578 using Equation (Exhibit 25-5)
V_{12} = 3224 pc/h
V_3 or V_{av34} 2354 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6544	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4190	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 32.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.510 (Exibit 25-19)
S_R= 48.9 mph (Exhibit 25-19)
S_0= 49.1 mph (Exhibit 25-19)
S = 49.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to ASR
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 2600 ft
V_D = 120 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5650	0.86	Level	2	0	0.990	1.00	6635
Ramp	1260	0.86	Level	2	0	0.990	1.00	1480
UpStream								
DownStream	120	0.86	Level	1	0	0.995	1.00	140

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = 358.21 (Equation 25-8 or 25-9)
P_{FD} = 0.526 using Equation (Exhibit 25-12)
V_{12} = 4192 pc/h
V_3 or V_{av34} 2443 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6635	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5155	Exhibit 25-14	6780	No
V_R	1480	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4192	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 34.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.496 (Exhibit 25-19)
S_R = 49.1 mph (Exhibit 25-19)
S_0 = 55.8 mph (Exhibit 25-19)
S = 51.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Northbound I-87
Agency or Company	CHA	Junction	Exit 4 NB Off to Wolf
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2600 ft
V_u = 1260 veh/h

Terrain: Level
S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4400	0.86	Level	2	0	0.990	1.00	5167
Ramp	120	0.86	Level	2	0	0.990	1.00	141
UpStream	1260	0.86	Level	1	0	0.995	1.00	1472
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.624 using Equation (Exhibit 25-12)
V_{12} = 3279 pc/h
V_3 or V_{av34} 1888 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5167	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	5026	Exhibit 25-14	6780	No
V_R	141	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3279	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 29.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.376 (Exhibit 25-19)
S_R= 50.7 mph (Exhibit 25-19)
S_0= 58.0 mph (Exhibit 25-19)
S = 53.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound
Agency or Company	CHA	Junction	Exit 2W Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1300 ft
V_D = 880 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4150	0.92	Level	2	0	0.990	1.00	4556
Ramp	480	0.92	Level	2	0	0.990	1.00	527
UpStream								
DownStream	880	0.92	Level	2	0	0.990	1.00	966

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.622 using Equation (Exhibit 25-12)
V_{12} = 3032 pc/h
V_3 or V_{av34} 1524 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4556	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	4029	Exhibit 25-14	6780	No
V_R	527	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3032	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = 27.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.410 (Exhibit 25-19)
S_R = 50.3 mph (Exhibit 25-19)
S_0 = 59.4 mph (Exhibit 25-19)
S = 53.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB Off
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 1585 ft
V_D = 1030 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3900	0.92	Level	2	0	0.990	1.00	4282
Ramp	830	0.92	Level	2	0	0.990	1.00	911
UpStream								
DownStream	1030	0.93	Level	4	0	0.980	1.00	1130

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R = mph (Exhibit 25-19)
S_0 = mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.611 using Equation (Exhibit 25-12)
V_{12} = 2971 pc/h
V_3 or V_{av34} 1311 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4282	Exhibit 25-14	6780	No
$V_{FO} = V_F - V_R$	3371	Exhibit 25-14	6780	No
V_R	911	Exhibit 25-3	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2971	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = 20.4 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.445 (Exhibit 25-19)
S_R = 49.8 mph (Exhibit 25-19)
S_0 = 60.2 mph (Exhibit 25-19)
S = 52.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 4 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 1585 ft
V_u = 830 veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3050	0.92	Level	2	0	0.990	1.00	3348
Ramp	1030	0.93	Level	4	0	0.980	1.00	1130
UpStream	830	0.92	Level	2	0	0.990	1.00	911
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 1231.95 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2057 pc/h
V_3 or V_{av34} 1291 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4478	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3187	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 21.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.310 (Exibit 25-19)
S_R= 51.7 mph (Exhibit 25-19)
S_0= 53.2 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SEB	Freeway/Dir of Travel	Southbound I-87
Agency or Company	CHA	Junction	Exit 5 SB On-Ramp
Date Performed	02/14/12	Jurisdiction	NYSDOT
Analysis Time Period	PM	Analysis Year	2036 Flyover

Project Description Exit 4

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 56.0 mph S_{FR} = 40.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 4700 ft
V_D = 830 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3250	0.92	Level	2	0	0.990	1.00	3568
Ramp	670	0.87	Level	1	0	0.995	1.00	774
UpStream								
DownStream	830	0.92	Level	2	0	0.990	1.00	911

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 3663.05 (Equation 25-2 or 25-3)
P_{FM} = 0.614 using Equation (Exhibit 25-5)
V_{12} = 2190 pc/h
V_3 or V_{av34} 1378 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4342	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2964	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.293 (Exibit 25-19)
S_R= 51.9 mph (Exhibit 25-19)
S_0= 52.8 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Northbound
Weaving Seg Location	Exit 2E on to 2W off
Jurisdiction	NYSDOT
Analysis Year	2036 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	815	Weaving ratio, R	0.36
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	4260	0.86	2	0	1.5	1.2	0.990	1.00	5003
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	880	0.92	2	0	1.5	1.2	0.990	1.00	966
V_{w2}	490	0.92	2	0	1.5	1.2	0.990	1.00	537
V_w				1503	V_{nw}				5003
V									6506

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.45	0.79		
Weaving and non-weaving speeds, Si (mi/h)	33.79	40.73		

Number of lanes required for unconstrained operation, Nw 1.32
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	38.89
Weaving segment density, D (pc/mi/ln)	41.83
Level of service, LOS	E
Capacity of base condition, c_b (pc/h)	6571
Capacity as a 15-minute flow rate, c (veh/h)	6506
Capacity as a full-hour volume, c_h (veh/h)	5690

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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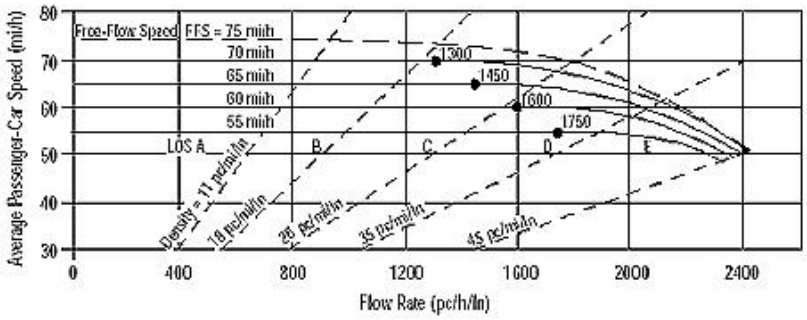
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*AM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5850*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2141*	pc/h/ln
S	*53.0*	mi/h
D = v_p / S	*40.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	SEB
Agency/Company	CHA
Date Performed	02/14/12
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-87 Southbound
Weaving Seg Location	Exit 2W on to 2E off
Jurisdiction	NYSDOT
Analysis Year	2036 Flyover

Inputs

Freeway free-flow speed, S_{FF} (mi/h)	56	Weaving type	A
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	810	Weaving ratio, R	0.15
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
V_{o1}	3500	0.92	2	0	1.5	1.2	0.990	1.00	3842
V_{o2}	0	0.92	2	0	1.5	1.2	0.990	1.00	0
V_{w1}	880	0.92	2	0	1.5	1.2	0.990	1.00	966
V_{w2}	150	0.92	2	0	1.5	1.2	0.990	1.00	164
V_w				1130	V_{nw}				3842
V									4972

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.0035		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	1.11	0.55		
Weaving and non-weaving speeds, Si (mi/h)	36.77	44.66		

Number of lanes required for unconstrained operation, Nw 1.26
Maximum number of lanes, Nw (max) 1.40

☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	42.58
Weaving segment density, D (pc/mi/ln)	29.19
Level of service, LOS	D
Capacity of base condition, c_b (pc/h)	6584
Capacity as a 15-minute flow rate, c (veh/h)	6519
Capacity as a full-hour volume, c_h (veh/h)	5997

Notes

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

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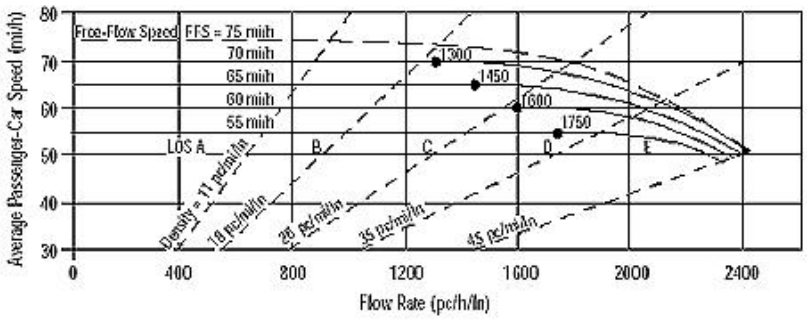
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4150*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1625*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*29.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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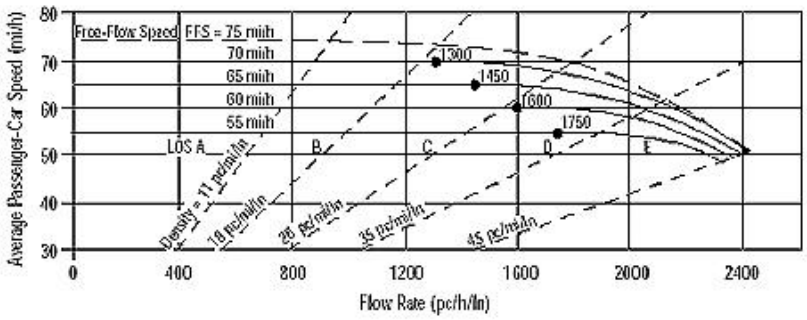
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Northbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 off*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*4250*	veh/h	Peak-Hour Factor, PHF	*0.86*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1664*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*29.7*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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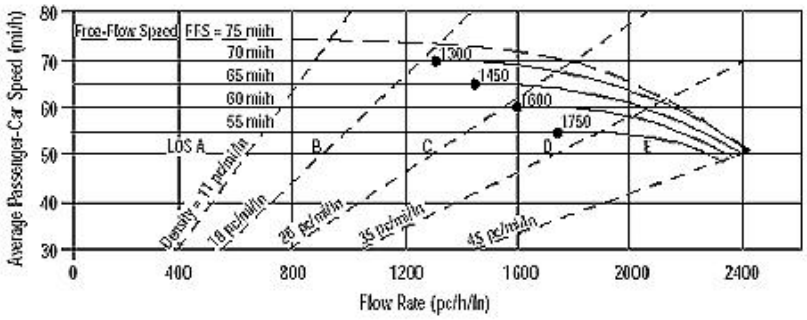
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 5 to Exit 4*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3900*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*3*	
FFS (measured)	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*56.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1427*	pc/h/ln
S	*56.0*	mi/h
D = v_p / S	*25.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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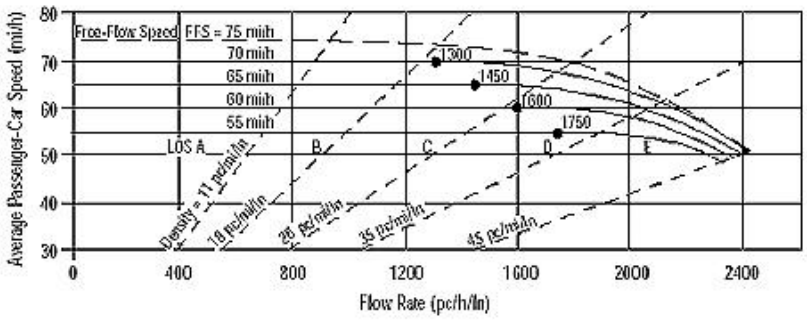
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*SEB*	Highway/Direction of Travel	*Southbound I-87*
Agency or Company	*CHA*	From/To	*Exit 4 off to Exit 4 on*
Date Performed	*02/14/12*	Jurisdiction	*NYSDOT*
Analysis Time Period	*PM*	Analysis Year	*2046 Flyover*

Project Description Exit 4

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3000*	veh/h	Peak-Hour Factor, PHF	*0.92*
AADT		veh/day	%Trucks and Buses, P_T	*2*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.990*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*3*		f_N		mi/h
FFS (measured)	*56.0*	mi/h	FFS	*56.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1098*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*56.0*	mi/h	S		mi/h
D = v_p / S	*19.6*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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ATTACHMENT F
ACCIDENT ANALYSIS

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

TO: A. Trichilo, R-1 Design, 3rd floor

FROM: M. Kennedy, R-1 Traffic Engineer, 4th floor

SUBJECT: Updated Accident History for PIN 1721.51
I87 Exits 3/4/5
Town of Colonie, Albany County

DATE: March 3, 2011

Attached please find updated accident data for the subject project, as you requested on 3/23/10. The accident data covers the 3.25 year study period from 1/1/07 to 3/31/10. The current High Accident Location (HAL) period is 11/1/07 to 10/31/09. There were no HALs on the section of I87 from RM 2016 to 2042 studied. NY 910B, Wolf Road, was a Priority Investigation Location from RM 1010 to 1015 and from RM 1016 to 1019. NY 155, Watervliet-Shaker Road, was a Safety Deficient Location from RM 3058 to 3060.

I87, the Northway, is a six lane divided Urban Principal Arterial Interstate highway with full control of access. There were 303 accidents on the section of I87 evaluated during the study period. The accident rate of 0.87 ACC/MVM is less than the expected accident rate of 1.10 ACC/MVM for similar highways statewide. The predominant accident type is rear end accidents. There were 52 accidents during the morning peak from 6 am to 9 am and 105 accidents occurred during the peak evening commute from 3 pm to 6 pm. There was one fatality and no accidents involving pedestrians or bicyclists. Accident summaries and a collision diagram of the southbound Exit5/Exit 4 merge/diverge area service road are provided.

There were 52 accidents in the first section of NY 910B studied and the accident rate is 2.41 ACC/MVM. This rate is less than the expected rate of 3.59 ACC/MVM for four lane divided Urban Principal Arterial highways with free access statewide. The majority of the accidents consisted of rear end and turning accidents due to traffic congestion. There was one accident involving a pedestrian and no accidents involving bicyclists. Of the 53 accidents on this section of highway with pavement condition reported, 14 (26%) occurred on wet pavement and none occurred on snow/ice/slush pavements. There were 7 accidents during the morning peak commute hours from 6 am to 9 am and 16 accidents occurred during the peak evening commute hours from 3 pm to 6 pm. A copy of Highway Safety Investigation report 1-1-0409 is attached.

Wolf.

There were 132 accidents in the second section of NY 910B studied and the accident rate is 9.46 ACC/MVM. This rate is greater than the expected accident rate of 3.59 ACC/MVM for four lane divided Urban Principal Arterial highways with free access statewide. The majority of the accidents consisted of rear end and turning accidents due to traffic congestion, particularly at the signalized intersection with Albany County Route 151, Albany-Shaker Road, at the RM 1019. There were no accidents involving pedestrians or bicyclists. Of the 127 accidents on this section of highway with pavement condition reported, 25 (20%) occurred on wet pavement and 5 (4%) occurred on snow/ice/slush pavements. There were 11 accidents during the morning peak commute hours from 6 am to 9 am and 34 accidents occurred during the peak evening commute hours from 3 pm to 6 pm. A signal study, completed 12/28/08, at the intersection with Ulenski Drive at RM 1017 resulted in no safety recommendation. A copy of Highway Safety Investigation report 1-1-0477, which includes the signal study, is attached.

NY 155, Watervliet-Shaker Road, is a four lane undivided Urban Minor Arterial highway with free access. There were 46 accidents on the SDL section of NY 155, from RM 3058 to 3061, evaluated during the period 1/1/07 to 9/30/10. The accident rate of 8.79 ACC/MVM is greater than the expected accident rate of 4.27 ACC/MVM for similar highways statewide. The predominant accident type is rear end accidents. Of the 46 accidents on this section of highway with pavement condition reported, 2 (4%) occurred on wet pavement and 3 (6%) occurred on snow/ice/slush pavements. There were 7 accidents during the morning peak from 6 am to 9 am and 12 accidents occurred during the peak evening commute from 3 pm to 6 pm. There were no accidents involving pedestrians or bicyclists.

Albany County Route 151, Albany-Shaker Road, carries NY Touring Route 155. There were 55 accidents on the section of CR 151 studied, from D'Alessandro Boulevard to Wolf Road. The predominant accident type is rear end accidents. Of the 52 accidents on this section of highway with pavement condition reported, 12 (23%) occurred on wet pavement and 2 (4%) occurred on snow/ice/slush pavements. There were 8 accidents during the morning peak from 6 am to 9 am and 18 accidents occurred during the peak evening commute from 3 pm to 6 pm. There were no accidents involving pedestrians or bicyclists. A signal study, completed 12/22/10, at the signalized intersection with Old Wolf Road and the I87 SB on ramp, resulted in a safety recommendation to refresh the pavement markings. A copy of Highway Safety Investigation report 1-1-0495, which documents the signal study, is attached.

Albany County Route 153, Old Wolf Road, carries NY Touring Route 155. There were 55 accidents on the section of CR 153 studied, from the intersection with AC Rout 151 to Northway Lane, which includes the signalized intersection with the ramp

from I87 SB. The predominant accident type is rear end accidents. Of the 28 accidents on this section of highway with pavement condition reported, 7 (25%) occurred on wet pavement and 1 (4%) occurred on snow/ice/slush pavements. There were 6 accidents during the morning peak from 6 am to 9 am and 13 accidents occurred during the peak evening commute from 3 pm to 6 pm. There were no accidents involving pedestrians and one involving a bicyclist. The accidents at the SB ramp junction ate plotted on the collision diagram with the ramp accidents.

The majority of the accidents on all the sections of highway reviewed in this study occurred during peak hours and are congestion related. Any project alternative that includes congestion mitigation measures will enhance the overall safety performance, in particular at the signalized junctions with the Exit 4 ramps and Wolf Road. We have no additional safety recommendations to make for the project as a result of our review of this accident history.

If you have any questions concerning this study, please contact Mike Doody of this office at 388-0372.

MJK:MED
Attachments

cc: J. Rutnik, R-1 Traffic, 4th floor

ACCIDENT SUMMARY SHEET

MUNICIPALITY Town of Colonie COUNTY Albany

LOCATION I87; RM 87I-1108-2016 TO 2042 ~~HSI #~~ PIN 1721.51

TIME PERIOD 1/1/07 TO 3/31/10 NO. OF MONTHS 39

Accident Type	No. of Accidents	
Right Angle	149	
Rear End	57	
Overtaking	9	
~~Left Turn~~ Debris	1	
Sideswipe/Head-on	5	
~~Right Turn~~ Equipment Malfunction	3	
Parked Vehicle		
Pedestrian		
Bicycle	12	
Animal Deer/Turkey	67	
Fixed Object		
w/Utility Poles		52
w/Guide Rail		7
w/Sign Posts		2
w/Trees		5
w/Ditch-Embank.		1
w/ fence		
TOTAL	303	

Pavement	No. of Accidents
Dry	223
Wet	43
Snow/Ice	35
Unknown	2
TOTAL	303

Weather	No. of Accidents
Clear	147
Cloudy	94
Rain	22
Snow	31
Sleet	5
Fog	2
Unknown	2
TOTAL	303

Light Conditions	No. of Accidents
Day	221
Night	82
Unknown	
TOTAL	303

Accident Severity	No. of Accidents
Fatal	1
Injury	66
Property Damage	236
TOTAL	303

NYSDOT Safety Information Management System

Expected Accident Rates State Highways - 2009

Includes Period from 01-NOV-2007 to 31-OCT-2009

Highway/Intersection

Classification Code: 18 FULL ACCESS, URBAN, DIVIDED, 6 LANE

Classification Type: A = ALL ACCIDENTS

	Accident Category	Mean Rate (acc/mvm)	95th Percentile Rate (acc/mvm)
01	OVERALL RATE	1.10	3.29
02	FATAL	.0	.02
03	INJURY	.40	1.26
04	PROPERTY DAMAGE ONLY	.69	2.25
05	NON-REPORTABLE	.01	.04
11	DRY ROAD	.74	2.18
12	WET ROAD	.21	.78
13	SNOW/ICE/SLUSH ROAD	.09	.60
14	ALL OTHER - ROAD SURFACE	.05	.26
21	LEFT-TURN	.01	.05
22	REAR-END	.40	1.29
23	OVERTAKING	.15	.56
24	RIGHT-ANGLE	.02	.09
25	RIGHT-TURN	.0	.02
26	HEAD-ON	.0	.02
27	SIDESWIPE	.0	.03
28	OTHER - MULTI. VEHICLE	.15	.51
41	COLL W/PEDESTRIAN	.01	.03
42	COLL W/BICYCLE	.0	.0
43	COLL W/ANIMAL/TRAIN/OTHER	.05	.28
44	FO:UTILITY/LIGHT POLES	.01	.06
45	FO:GRAIL/MBARRIER/CUSHION	.15	.73
46	FO:SIGN/CURB/FENCING	.02	.14
47	FO:DITCH/BRIDGE/CULVERT	.02	.14
48	FO:TREE/HYDRANT/OTHER	.02	.14
49	RUN-OFF-ROAD/OVERTURN	.01	.08
50	NON COLLISION	.02	.12

Program: sass1701

NYSDOT Safety Information Management System
Accident Severity Summary
Intersection & Non-Intersection Accidents

Date: 02/16/11 12:35

Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

Route: 87I Highway Location Ref Mrkr Range: 87I11082016 - 87I11082042

Dates: 01-JAN-2007 thru 31-MAR-2010 Traffic Volume: 108,250

Total of Fatal Accd	Total of Injury Accd	Total of PDO Accd	Total of Non-Reportable	Total Number of Accidents	Accident Rate
1	70	158	73	302	.87

Accident rate for linear section is accidents per million vehicle miles.

NYSDOT Safety Information Management System
Summary Report By Segment And/Or Intersection
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

ROUTE: 87I HIGHWAY LOCATION: 87I11082016 - 87I11082042 DATES: 01-JAN-2007 - 31-MAR-2010

REFERENCE	INT.	DESCRIPTION	NUMBER OF ACCIDENTS - TOTAL	FTL	INJ	PDO	N/R	WET ROAD **	FIXED OBJ **	PED& BIKE **	TRUCK *** **	LIGHT CONDITION DWN/DSK **	DAY **	NIGHT **
87I 1108 2016		COLONIE VILLAGE/COLONIE TOWN LI	7	0	1	5	1	1	2	0	0	1	3	3
87I 1108 2017			7	0	1	3	3	2	1	0	1	0	3	4
87I 1108 2018			8	0	0	4	4	1	0	0	0	1	6	1
87I 1108 2019			5	0	1	2	2	1	0	0	1	0	3	2
87I 1108 2020			8	0	1	4	3	1	1	0	0	0	7	1
87I 1108 2021			10	0	4	4	2	3	3	0	1	0	8	2
87I 1108 2022			6	0	1	0	5	1	0	0	0	0	6	0
87I 1108 2023			10	0	1	6	3	0	3	0	0	3	6	1
87I 1108 2024			12	0	1	7	4	2	4	0	1	1	8	3
87I 1108 2025			17	0	5	10	2	4	6	0	2	3	12	2
87I 1108 2026			17	0	5	9	3	1	5	0	2	0	12	5
87I 1108 2026	09	NB OFF RAMP TO WOLF RD	5	0	2	1	2	1	2	0	0	0	2	2
87I 1108 2026	10	SB ON RAMP FROM ALBANY SHAKER RD	6	0	3	2	1	2	1	0	1	0	5	1
87I 1108 2027			16	0	5	8	3	2	2	0	0	2	10	4
87I 1108 2028			4	0	0	3	1	0	0	0	0	1	3	0
87I 1108 2029			5	0	2	3	0	0	3	0	1	0	4	1
87I 1108 2030			7	0	4	2	1	0	2	0	0	0	4	3
87I 1108 2030	12	SB ON RAMP FROM NY 155	11	0	5	3	3	4	2	0	0	0	10	1
87I 1108 2031			5	0	2	1	2	0	1	0	1	1	4	0
87I 1108 2032			12	0	4	5	3	2	0	0	2	1	9	2
87I 1108 2032	01	NB ON RAMP FROM WOLF RD	5	0	1	4	0	1	0	0	0	0	2	3
87I 1108 2033			5	0	1	4	0	0	2	0	2	0	4	1
87I 1108 2034			11	0	1	7	3	1	5	0	0	0	11	0
87I 1108 2035			6	0	1	3	2	1	2	0	2	0	4	2
87I 1108 2035	13	SB OFF RAMP TO WOLF RD	22	0	6	12	4	4	2	0	0	0	17	5
87I 1108 2036			10	0	2	4	4	1	2	0	3	0	5	4
87I 1108 2037			5	0	2	3	0	0	1	0	0	0	3	1

** EXCLUDES PARTIALLY CODED NON-REPORTABLES *** EXCLUDES PICKUPS & VANS

NYSDOT Safety Information Management System
Summary Report By Segment And/Or Intersection
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

ROUTE: 87I HIGHWAY LOCATION: 87I11082016 - 87I11082042 DATES: 01-JAN-2007 - 31-MAR-2010

REFERENCE	INT.	DESCRIPTION	NUMBER OF ACCIDENTS TOTAL	FTL	INJ	PDO	N/R	WET ROAD **	FIXED OBJ **	PED& BIKE **	TRUCK *** **	LIGHT CONDITION DWN/DSK **	DAY **	NIGHT **
87I 1108 2038			15	0	2	10	3	1	4	0	3	0	13	2
87I 1108 2038	15	NB OFF RAMP TO NY 155	5	0	1	4	0	0	5	0	0	0	3	2
87I 1108 2039			11	0	1	7	3	3	1	0	0	0	10	1
87I 1108 2039	14	SB OFF RAMP TO NY 155	3	0	0	3	0	0	3	0	0	0	0	3
87I 1108 2040			10	0	1	8	1	1	2	0	1	0	6	4
87I 1108 2040	16	NB ON RAMP FROM NY 155	2	0	0	2	0	0	0	0	0	0	2	0
87I 1108 2041			9	1	2	4	2	1	0	0	2	0	8	1
87I 1108 2042			5	0	1	1	3	1	0	0	1	0	3	2
		ROUTE TOTAL EXCLUDES 999 RMS	302	1	70	158	73	43	67	0	27	14	216	69

** EXCLUDES PARTIALLY CODED NON-REPORTABLES

*** EXCLUDES PICKUPS & VANS

NYSDOT Safety Information Management System

Summary Report By Accident Category

Intersection & Non-Intersection Accidents

Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

ROUTE: 87I HIGHWAY LOCATION 87I 1108 2016 - 87I 1108 2042
DATES: JAN-01-2007 - MAR-31-2010

REPORTABLE ACCIDENTS BY YEAR AND SEVERITY

TIME PERIOD	FATAL	INJURY	P-D-O	NON-REPORTABLE	TOTALS
JAN-01-2007 - DEC-31-2007	0	25	56	30	111
JAN-01-2008 - DEC-31-2008	1	20	45	15	81
JAN-01-2009 - DEC-31-2009	0	20	44	24	88
JAN-01-2010 - MAR-31-2010	0	5	13	4	22
TOTALS	1	70	158	73	302

TE 156a (3/76)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION
HIGHWAY SAFETY
INVESTIGATION REPORT
(SEE INSTRUCTIONS ON REVERSE)

MAIN OFFICE USE:
DIVISION FILE
REVIEWED BY
SCHEDULED FOR B&A ☐

1. LOCATION

IDENT. NO.: 1 1 0 1 0 0

☒ TOWN ☐ CITY ☐ VILLAGE } OF Colonie

ROUTE NO. OR STREET NAME	STATE HIGHWAY NO.	FROM OR AT REFERENCE MARKE
NY 155 / Watervliet-Shaker Rd	879	1 5 5 | 1 1 0 1 | 3 0 5
At Intersection With (If Applicable) ROUTE NO. OR STREET NAME: I 87 Exit 5	STATE HIGHWAY NO.	TO REFERENCE MARKER: 1 5 5 | 1 1 0 1 | 3 0 [illegible]

2. REASON FOR INVESTIGATION
- ☒ (a) IDENTIFIED BY ACCIDENT SURVEILLANCE SYSTEM
- ☐ (b) POLICE HAZARD REPORT
- ☐ (c) RESPONSE TO COMPLAINT OR INQUIRY
- ☒ (d) REGIONALLY INITIATED PIN 1721.51
- ☐ (e) OTHER (Explain) _____

3. RECOMMENDATION
- ☐ (a) CAPITAL IMPROVEMENT (Initiate Proj. Devel. Study
- ☐ (b) TRAFFIC CONTROL IMPROVEMENT
- ☐ (c) MAINTENANCE IMPROVEMENT
- ☐ (d) OTHER
- ☒ (e) NONE

} complete sections 4 &

4. DISCUSSION (Use reverse if additional space is required – check box if reverse is used ☐)

(a) PROBLEMS IDENTIFIED

See attached Page 2 of 2

(b) PROPOSED SOLUTION

Reduction Index: Severity Ra-

2009 SDL RM 3058 TO 3060 — 7.37 — 2.42

(c) ACTION TAKEN

5. ACCIDENT EXPERIENCE

Number of Months	PERIOD BEGINNING: MONTH	PERIOD BEGINNING: YEAR	NUMBER OF ACCIDENTS: Fatal Accidents	Injury Accidents	Property Damage Accidents
1 0	0 1	0 7	0	4	8
2 4	1 1	0 7	0	9	16
1 1	1 1	0 9	0	3	6

6. BENEFIT/COST ANALYSIS (see instructions)

Check box if Benefit/Cost Calculations are attached ☐

PRINCIPAL INVESTIGATOR: [signature] TITLE: CEI

APPROVED BY: [signature] DATE: 3/3/11

Problems Identified

NY Route 155 was identified as a Safety Deficient Location (SDL) from RM 3058 to 3060 based on reportable accidents during the period 11/1/07 to 10/31/09. We evaluated the 0.4 mile section from RM 3058 to 3061 to include all the ramps to and from the Northway Exit 5. This section of NY 155 is a four lane undivided Urban Minor Arterial highway with free access traveling east-west. The highway travel lanes are 12 feet wide and there are 4 foot shoulders. The posted speed limit is 40 MPH. Pavement, pavement markings and signing are satisfactory.

Eastbound NY 155, Watervliet Shaker Road, is intersected from the north by Sherwood Drive in a stop controlled T-intersection at RM 3058. At RM 3059 are the Exit 5 SB on and off ramps. The intersection is controlled with a three color traffic signal. At RM 3060 Old Niskayuna Road, Albany County Route 152, intersects NY 155 from the south in a stop controlled T-intersection. Also at RM 3060 just east of Old Niskayuna Road, is an intersection with Swayzee Drive to the south, Swayzee Drive is one-way SB. At RM 3061 are the I87 Northway Exit 5 NB on and off ramps to the north opposite Holly Lane to the south. The intersection is controlled with a three color traffic signal. Also at RM 3061 just east of the signalized intersection, Feiden Lane intersects NY 155 from the south in a stop controlled T-intersection.

During the 45 month accident study period from 1/1/07 to 9/30/10 there were 46 total accidents. The accident rate was 8.79 ACC/MVM, which is greater than the expected accident rate of 4.27 ACC/MVM for similar highways statewide. Of the 46 accidents with pavement condition reported, there were 2 (4%) wet pavement accidents and 3 (6%) snow/ice pavement accidents. Overall, 23 of the 46 accidents occurred at the two signalized intersections, including 8 rear end accidents, 8 left turn accidents, and 3 right angle accidents. There were 7 accidents during the morning peak from 6 am to 9 am and 12 accidents during the evening peak from 3 pm to 6 pm. There is no apparent treatable pattern of accidents.

Proposed Solution

The scope of PIN 1721.51, I87/NY910B interchange (Exit 4) reconstruction, has been expanded to possibly include work at Exit 5. We have no safety improvements to offer for the project at this time as a result of this review of the accident history.

Actions Taken

Memo to R-1 Design, dated 2/24/11.

Program: sass1701

NYSDOT Safety Information Management System
Accident Severity Summary
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

Date: 01/31/11 14:27

Route: 155 Highway Location Ref Mrkr Range: 155 11013058 - 155 11013061

Dates: 01-JAN-2007 thru 30-SEP-2010 Traffic Volume: 9,560

Total of Fatal Accd	Total of Injury Accd	Total of PDO Accd	Total of Non-Reportable	Total Number of Accidents	Accident Rate
0	17	26	3	46	8.79

Accident rate for linear section is accidents per million vehicle miles.

Program: sass1704

NYSDOT Safety Information Management System
Summary Report By Segment And/Or Intersection
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

Date: 01/31/11 14:27

ROUTE: 155 HIGHWAY LOCATION: 155 11013058 - 155 11013061 DATES: 01-JAN-2007 - 30-SEP-2010

REFERENCE	INT.	DESCRIPTION	NUMBER OF ACCIDENTS											
			TOTAL	FTL	INJ	PDO	N/R	WET ROAD **	FIXED OBJ **	PED& BIKE **	TRUCK *** **	LIGHT CONDITION DWN/DSK **	DAY **	NIGHT **
155 1101 3058			2	0	1	0	1	0	0	0	0	0	2	0
155 1101 3058	92	SHERWOOD DR	1	0	1	0	0	0	0	0	0	0	1	0
155 1101 3059			1	0	1	0	0	1	0	0	0	0	1	0
155 1101 3059	93	I87 SB ON & OFF RAMPS - EXIT 5	15	0	7	7	1	1	0	1	2	0	11	4
155 1101 3060			1	0	0	1	0	0	1	0	0	0	0	1
155 1101 3060	98	CR 152 OLD NISKAYUNA RD	15	0	3	12	0	1	0	0	1	0	12	2
155 1101 3060	95	SWAYZEE DR	2	0	1	1	0	1	0	0	0	0	2	0
155 1101 3061			1	0	0	1	0	0	0	0	0	0	1	0
155 1101 3061	96	I87 NB ON & OFF RAMPS & HOLLY LANE	8	0	3	4	1	0	1	0	0	1	4	2
		ROUTE TOTAL EXCLUDES 999 RMS	46	0	17	26	3	4	2	1	3	1	34	9

** EXCLUDES PARTIALLY CODED NON-REPORTABLES

*** EXCLUDES PICKUPS & VANS

ACCIDENT SUMMARY SHEET

Case # _____

Municipality Town of Colonie County ALBANY

Location N/S Route 155. RIN 155-1101-3058 TO 3061 HSI # 1-1-0100

Time Period 1/1/07 - 11/30/10 No. of Months 47

Accident Type	No. of Accidents
Rear End	23
Right Angle	9
Overtaking	2
Left Turn	10
Sideswipe/ Head-on	
Right Turn	
Parked Vehicle	
Debris	
Pedestrian	
Bicycle	
Animal	
Backing	
Fixed Object	3
w/ Utility Poles	1
w/ Guide Rail / Barrier	1
w/ Sign Post	
w/ Trees	
W/ Ditch / Embankment	1
w/	
TOTAL	48

Pavement Condition	No. of Accidents
Dry	41
Wet	2
Snow / Ice / Slush	3
Unknown	2
TOTAL	48

Weather	No. of Accidents
Clear	29
Cloudy	14
Rain	2
Snow	2
Sleet	
Fog	
Unknown	2
TOTAL	48

Light Conditions	No. of Accidents
Day	37
Night	10
Unknown	1
TOTAL	48

Accident Severity	No. of Accidents
Property Damage	30
Injury	18
Fatal	
TOTAL	48

ACCSUMM.wpd

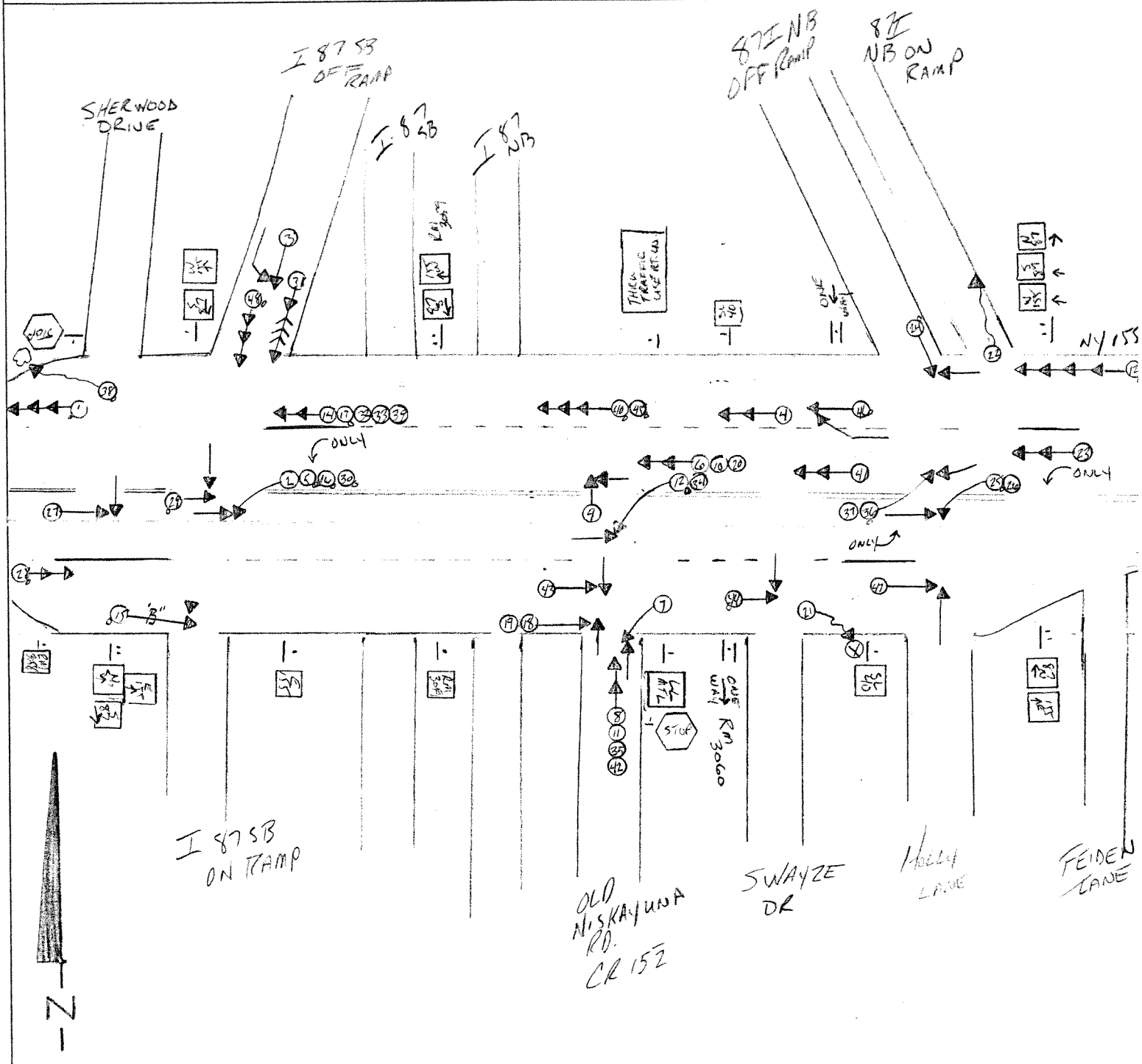
TE 56 (11/07)c

NYS DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & MOBILITY / OFFICE OF MODAL SAFETY & SECURITY
COLLISION DIAGRAM # 3

Sheet 1 o

Municipality TOWN OF COLONIE County ALBANY
Intersection NY ROUTE 155 RM 155-1101-3058 - RM 3061
Period 4 Years 0 Months From 1/1/07 To 12/31/10

HSI # 1-1-0100 Case #
File DMV/SIMS/ALIS
By JJC Date 1/28/11



SYMBOLS		MANNER OF COLLISION	
Moving Vehicle	Pedestrain	Rear-end	Head-on
M Motorcycle	B Bicycle	Overtaking	
Backing Vehicle	Fixed Object	Out of control	Left-turn
Stopped Vehicle	Personal Injury	Skidding	
Parked Vehicle	Fatal Injury	Overturned	Right-angle

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 3

COUNTY ALBANY
☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

~~P.I.N.~~ OR IDENT. 1101106

ROUTE NO. OR STREET NAME: NY Route 155

AT INTERSECTION WITH/OR BETWEEN: Rte 155 - 1101 - 3058 - 3060

CASE NO.
FILE DMV/Sims/ACIS
BY JJC
DATE 1/28/11

TIME PERIOD
NUMBER OF MONTHS: 47
FROM: 1/1/07
TO: 11/30/10

ENVIRONMENTAL (Use codes from MV 104 (shown at right) for these categories)

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
1	3/8/07	0831	3	PI	1	1	1	1	4	3058	WB V_3 & V_2 STOPPED WAITING FOR UNINVOLVED V TO TURN LEFT V. R/E V_2 INTO V_3
2	3/2/07	1955	2	PDO	4	1	4	1	7	3059	WB U. TURNS LEFT IN FRONT OF EB U_2
3	7/20/07	1015	2	PDO	1	1	1	2	20	3059	SB U. PULLS FROM SHOULDER STRIKING SB U_2
4	11/3/07	1415	2	PDO	1	1	1	2	4	3059	WB U, LISTENING TO BACK SEAT PASSENGER R/E V_2
5	12/25/07	2307	2	PI	4	1	1	2	7, 5	3059	WB V_1 TURNS LEFT IN FRONT OF EB V_2
6	2/8/07	1403	2	PDO	1	1	1	1	4	3060	WB V_2 STOPPED WAITING TO TURN, WB V_1 R/E V_2
7	2/12/07	1448	2	PDO	1	1	1	2	18	3060	WB U, MAKES LEFT TURN, STRIKES STATIONARY NB V_2
8	4/11/07	1613	2	PDO	1	1	1	1	4	3060	NB V. R/E NB U_2
9	7/10/07	1505	2	PDO	1	1	1	2	69, 4	3060	NB U, PULLS OUT - (VIEW OBSTRUCTED BY CONSTRUCTION EQUIP) STRIKES WB U_2
10	7/20/07	2139	2	PI	4	1	1	1	4	3060	WB U_2 R/E WB U_1
11	8/1/07	0848	2	PDO	1	1			4	3060	NB U, R/E NB V_2
12	8/28/07	1502	2	PI	1	1	1	1	7	3060	WB U, TURNED LEFT IN FRONT OF EB U_2
13	10/30/07	2042	4	PI	4	1	1	1	2	3060	WB U. (DWI) R/E U_2 INTO U_3 INTO U_4
14	3/14/08	1624	2	PDO	1	1	1	2	4, 9	3059	WB U, R/E WB U_2
15	6/2/08	1902	2	PI	1	1	1	2	17	3059	WB U, TURNING ONTO RAMP W/ GREEN ARROW EB U_2 (BICYCLE) PASSES THROUGH RED SIGNAL STRUCK BY U_1
16	6/27/08	2243	2	PI	4	1	1	2	7	3059	WB V_1 TURNS LEFT IN FRONT OF EB V_2

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 3

COUNTY ALBANY — ~~P.I.N.~~ OR IDENT. 1 1 0 1 0 0

☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME: NY Route 155

AT INTERSECTION WITH/OR BETWEEN: RM 155 - 1191 - 3058 - RM 3061

CASE NO.
FILE DMV/SIMS/AIS
BY LLC
DATE 1/28/11

TIME PERIOD — NUMBER OF MONTHS: 47 — FROM 1/1/07 TO 11/30/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

(1) NO	(2) DATE	(3) TIME	(4) NO. OF VEH.	(5) SEVERITY	(6) LIGHT CONDITIONS	(7) ROADWAY CHARACTER	(8) ROADWAY SURFACE CONDITION	(9) WEATHER	(10) APPARENT CONTRIBUTING FACTORS	RM	(11) DESCRIPTION
17	11/6/08	0733	2	PI	1	1	1	1	4	3059	WB V1 R/E WB V2
18	1/23/08	1230	2	PDO	1	1	1	2	7	3060	NB V1 PULLS OUT IN FRONT OF EB V2
19	4/4/08	1152	2	PDO	1	1	1	1	7	3060	NB V1 PULLS OUT IN FRONT OF EB V2
20	6/2/08	1644	2	PDO	1	1	1	1	42	3060	WB V1 R/E WB V2 (V1 STATES BRAKES DEFECTIVE)
21	10/10/08	2313	1	PDO	4	1	1	1	26	3060	EB V1 STATES VEH DRIFTED INTO HER LANE V1 SWERVED STRUCK UTILITY POLE
22	1/16/08	1200	1	PDO	1	1	4	4	66	3061	NB V1 LOST CONTROL ON BLACK ICE AT ON RAMP STRUCK GUIDERAIL
23	4/8/08	1650	2	PDO	1	1	1	1	9	3061	WB V1 R/E WB V2
24	4/21/08	1541	2	PDO	1	1	1	1	7, 4	3061	SB V1 EXITED OFF RAMP IN FRONT OF WB V2
25	6/21/08	0657	2	PI	1	1	1	1	7	3061	WB V1 TURNS LEFT IN FRONT OF EB V2
26	8/8/08	?	2	PDO					7	3061	V1 TURNED IN FRONT OF V2
27	5/20/09	1327	2	PDO	1	1	1	1	7, 69	3058	SB V1 DISREGARDS TRAFFIC CONTROL DEVICE PULLS INTO PATH OF EB V2
28	7/6/09	1716	2	PI	1	1	1	1	4	3058	EB V1 R/E EB V2
29	1/2/09	0803	2	PI	1	1	2	2	66	3059	SB V1 LOST CONTROL ON SLIPPERY PVMT. STRUCK STATIONARY V2
30	1/14/09	2049	2	PI	4	1	4	4	7, 2	3059	WB V1 TURNS LEFT IN FRONT OF EB V2 V1 DRI
31	8/12/09	0837	2	PDO	1	2	1	2	3	3059	SB V1 BACKS UP RAMP INTO SB V2
32	8/26/09	1152	2	PDO	1	1	1	2	4	3059	WB V1 R/E WB V2

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 3

SHEET 4 OF 4

COUNTY ALBANY ~~P.I.N.~~ OR IDENT. 110100

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY Route 155

AT INTERSECTION WITH/OR BETWEEN: RM 155-1101-3058 - RM 3061

CASE NO.
FILE DMV/SIMS/MIS
BY JJC
DATE 1/28/11

TIME PERIOD: NUMBER OF MONTHS 47 FROM 1/1/07 TO 11/30/10

ENVIRONMENTAL: Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
33	9/13/09	1147	2	PDO	1	1	1	1	4	3059	WB V1 R/E WB V2
34	1/14/09	1139	2	PDO	1	1	1	1	7	3060	WB V1 TURNS LEFT INTO EB V2
35	7/13/09	1752	2	PDO	1	1	1	1	9	3060	NB V1 R/E NB V2
36	2/1/09	2007	2	PI	4	1	1	1	17	3061	EB V1 TURNED LEFT IN FRONT OF WB V2
37	10/12/09	2021	2	PDO	4	1	1	2	7, 17	3061	EB V1 TURNED LEFT IN FRONT OF WB V2
* ~~38~~	12/12/10	0159	1	PI	4	1	1	1	8	3058	WB V1 FELL AS LEEP, WENT OFF ROAD STRUCK TREE
39	3/4/10	1213	2	PDO	1	1	1	2	9	3059	WB V1 R/E WB V2
40	4/17/10	1248	3	PI	1	1	2	3	4	3059	WB V1 R/E WB V2 INTO WB V3
41	4/15/10	1124	2	PDO	1	1	1	1	4, 26	3060	WB V1 R/E WB V2
42	6/22/10	0750	2	PDO	1	1	1	1	4	3060	NB V1 R/E NB V2
43	7/6/10	1717	2	PDO	1	1	1	1	7	3060	WB V1 MAKING LEFT, WAVED ON BY EB VEH. V1 STRUCK BY EB V2
44	7/23/10	1544	2	PI	1	1	2	3	7, 26	3060	WB V1 MAKING LEFT, WAVED ON BY EB V V1 STRUCK BY EB V2
* 45	11/24/10	1108	3	PI	1	1	1	2	9	3060	WB V1 R/E V2 INTO WB V3
46	3/4/10	1455	2	PDO	1	1	1	1	20	3061	WB V2 CHANGED LANES BUMPING WB V1
47	4/20/10	0548	2	PDO	2	1	1	1	17	3061	NB V1 PULLED INFRONT OF EB V2
48	7/13/10	1505	3	PI	1	1	1	2	4	3059	SB V1 R/E V2 INTO V3

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION - REGION ONE
328 STATE STREET
SCHENECTADY, NEW YORK 12305
www.nysdot.gov

MARY E. IVEY
REGIONAL DIRECTOR

STANLEY GEE
ACTING COMMISSIONER

CASE# 1090278

December 22, 2010

Mr. Mike Greenberg
11 Bittersweet Lane
Slingerlands, New York 12159

Re: Traffic Signal Operational Review
Albany Shaker Road @ Old Wolf Road, Signal #104
Town of Colonie, Albany County

Dear Mr. Greenberg:

This letter is in response to your December 7, 2009 message to NYSDOT.gov in which you express concern for the operation of the traffic signal at the intersection of Route 155 (Old Wolf Road) and Albany-Shaker Road in the Town of Colonie. Your message stated that the stop bar for westbound vehicles on Albany-Shaker Road is pushed into the intersection, which makes it difficult for southbound left turning vehicles on Old Wolf Road to perform their turning maneuver. You suggested the stop bar on Albany-Shaker Road be moved back.

We have completed our study of the intersection. Our investigation included observing the flow of traffic through the area during peak traffic periods, and reviewing the accident records for the intersection. The accident study did not identify a pattern of accidents related to the position of the stop bar, and our observations did not identify any operational issues. Our observations and the data collected during this study do not justify any changes to the stop bar at this time. The dotted 'skip marks' that separate the two southbound left turn lanes were observed to be faded during our field work. These dotted lines delineate the turn lanes and identify the desired turning path for left turning vehicles. A work order was issued in September to re-apply these markings. The work was completed in October.

If you have any questions, please contact Rob Fitch of this office at 388-0380.

Sincerely,

Mark Kennedy
Regional Traffic Engineer

cc: D. Rose, Acting Albany County Resident Engineer
M. Doody, Traffic Engineering and Safety, Region 1

Old Wolf @ ASR 7/8/10

AM Peak Observation - similar to previous observation
Begin 7:20
End 9:20

- WB left turners stop ~ 5-10 feet short of stop bar generally
- Due to the tight geometry, the SB LT is a slow movement - vehicles drive straight into the intersection and then make a slow sharp left turn.
- Lane usage in left-most left turn lane is very tight - most vehicles use the right-most lane
- No conflicts observed

PM Peak observations - Similar to above

If we were building this intersection today, we would try to widen the exit point (throat) on ASR to facilitate the move. While the geometry does require motorists to be cautious, it has not caused any accident problem operational issues. The cat tracks for the dual lefts were not re-striped during the last durable markings contract (even though the rest of the intersection was done). I am working w/ Lorenzo to get them done under the current contract. This should help vehicles align themselves through the intersection.

→ No changes are justified

RFF 9/15/10

The stop bar on ASR is pushed as far west as possible in order to maximize storage (which is severely limited) under the bridge.

CASE #1090278

RESPONSE DUE BY 3/8/10

ROB 12/8/09

From: Mark Pyskadlo
To: mikeyg512@gmail.com
Date: 12/8/2009 2:27 PM
Subject: Re: NYSDOT COMMENT, Albany Shaker Road @ Old Wolf & I-87 Exit 4 SB on ramp, Signal #104, Albany County

Dear Mr. Greenberg:

We will initiate a study of the intersection in response to your concern and respond back to you with the results. It will take approximately 90 days to complete the study.

Sincerely,

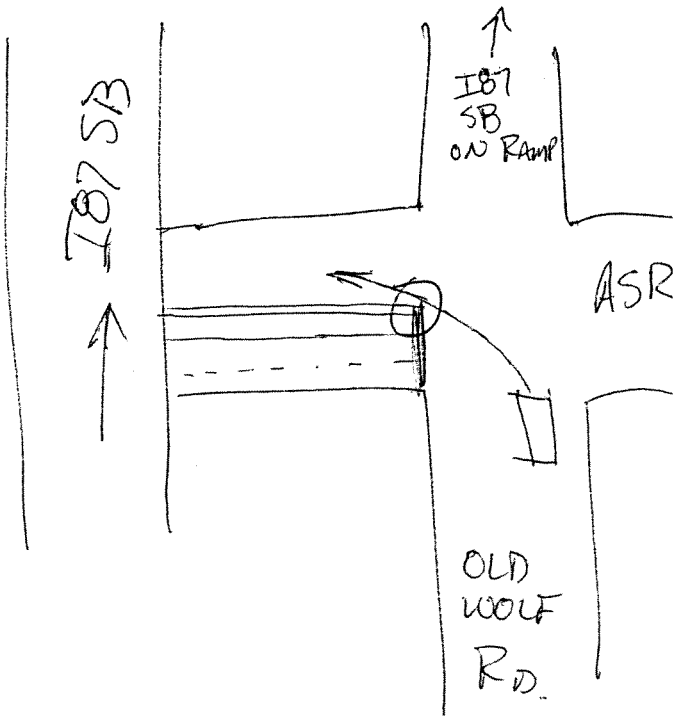
Mark A. Pyskadlo, P.E.
Traffic Engineering & Safety
NYSDOT - Region One
328 State Street - 4th Floor
Schenectady, NY 12305
(518) 388-0380, Fax: (518) 388-0379
MPYSKADLO@DOT.STATE.NY.US

>>> no-reply@dot.state.ny.us 12/7/2009 11:21 AM >>>
The following data was entered at NYSDOT.gov

Name - Mike Greenberg
Address - 11 Bittersweet Lane Slingerlands, NY
Email Address - mikeyg512@gmail.com
Comment Topic - NYSDOT COMMENT - Highways/Roads
Question or Comment -
I was turning onto Albany-Shaker Road from Wolf road in order to access the I-87 Southbound ramp. While waiting at the traffic light at Albany-Shaker road and 155 in the left turning lane that would lead me onto the ramp, I notice that the turning lane is pretty far up such that cars turning left from 155 onto Albany-Shaker Road towards wolf road have to use high caution when making that turn so they don't clip the lead car waiting to turn onto I 87. I am wondering if someone could take a look at this and perhaps back up that stop line so that it gives the people turning from 155 onto Albany-Shaker Road more room to turn. Thank you for your time! Page Accessed From:

ACCIDENT DIAGRAM & OBSERVE

- HDM Chapter 5
  - throat width 8-9 m
  - turning radii



ACCIDENT SUMMARY SHEET

MUNICIPALITY Town of Colonie COUNTY Albany

LOCATION AC Route 151 @ AC Route 153 (TH rm 3047) HSI # 1-1-0495

TIME PERIOD 1/1/07 to 12/31/09 NO. OF MONTHS 36

Accident Type	No. of Accidents	
Right Angle	3	
Rear End	11	
Overtaking	1	
Left Turn	5	
Sideswipe/Head-on		
Right Turn		
Parked Vehicle		
Pedestrian		
Bicycle		
Animal		
Fixed Object	1	
w/Utility Poles		
w/Guide Rail		
w/Sign Posts		1
w/Trees		
w/Ditch-Embank.		
w/		
TOTAL	21	

Pavement	No. of Accidents
Dry	11
Wet	5
Snow/Ice	2
Unknown	3
TOTAL	21

Weather	No. of Accidents
Clear	10
Cloudy	5
Rain	2
Snow	1
Sleet	
Fog	
Unknown	3
TOTAL	21

Light Conditions	No. of Accidents
Day	15
Night	4
Unknown	2
TOTAL	21

Accident Severity	No. of Accidents
Fatal	—
Injury	8
Property Damage	13
TOTAL	21

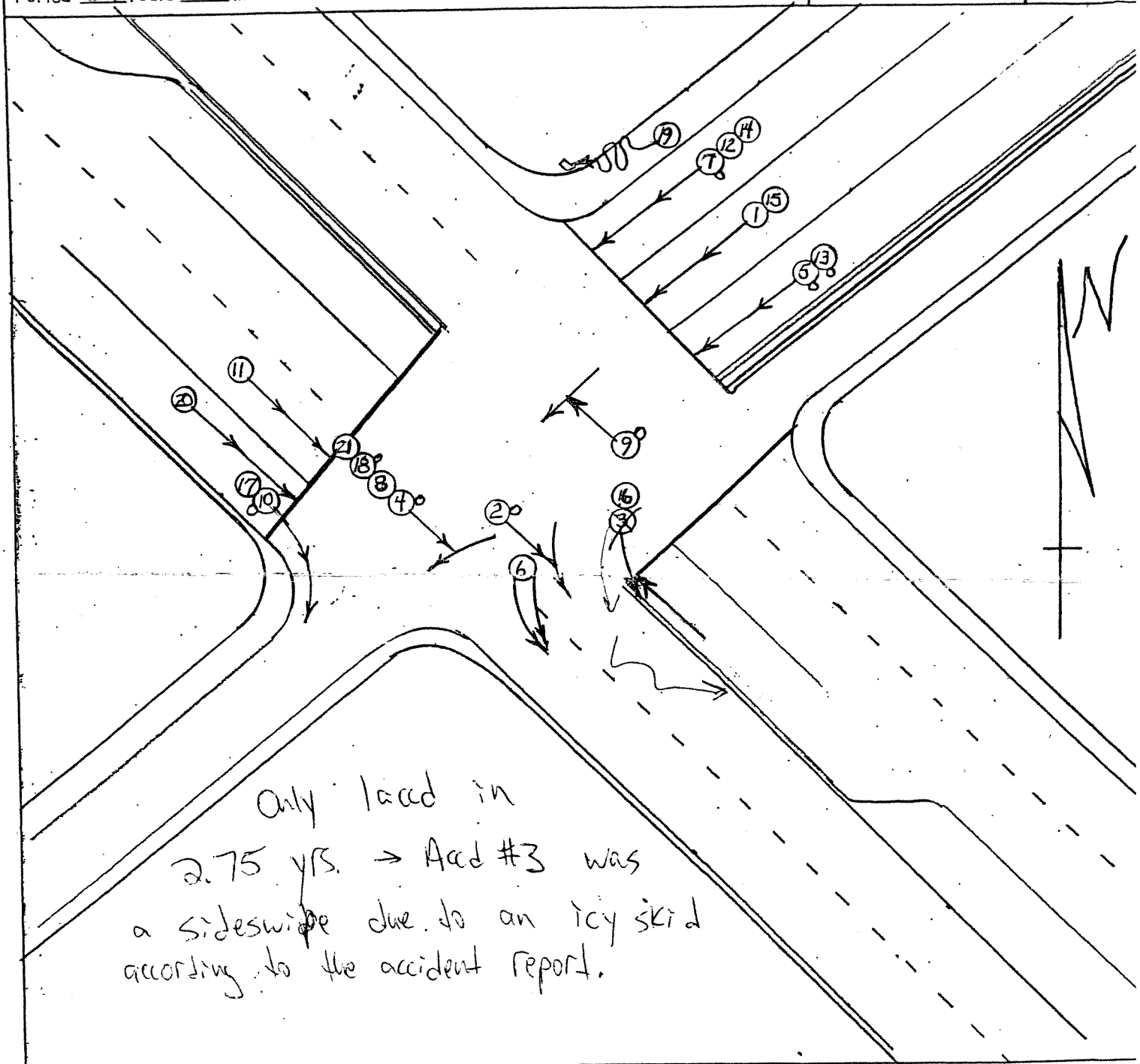
TE 56 (4/69)

DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING AND SAFETY DIVISION
COLLISION DIAGRAM 3

Sheet 1 of 3

Municipality TOWN OF COLONIE County ALBANY
Intersection ALBANY SHAKER RD (N.Y. 155) / OLD LOUDON RD / I-87 Ramp
Period 3 Years 9 Months From 1/1/07 To 12/31/09

File D.M.V.
By D.T.W. Date 1/13/10



Only 1 acc in 2.75 yrs. → Acc #3 was a sideswipe due to an icy skid according to the accident report.

SYMBOLS		MANNER OF COLLISION	
Moving Vehicle	Pedestrain	Rear-end	Head-on
M—Motorcycle	B—Bicycle	Side-swipe	
Backing Vehicle	Fixed Object	Out of control	Left-turn
Stopped Vehicle	Personal Injury	Skidding	
Parked Vehicle	Fatal Injury	Overturned	Right-angle

TE 213 (9/79) SIGT04

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 3 SHEET 2 OF 3

COUNTY ALBANY OR IDENT. ~~P.I.N.~~ 1 10 4 95
☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME ALBANY SHAKER RD (N.Y. 155)

AT INTERSECTION WITH/OR BETWEEN OLD WOLF RD. (N.Y. 155) & I-87 S.B. ON-RAMP

CASE NO. 1090278
FILE DMV
BY D.T.W.
DATE 4/13/10

TIME PERIOD
NUMBER OF MONTHS 36
FROM 1/1/07
TO 12/31/09

ENVIRONMENTAL Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

	① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	⑪ DESCRIPTION
#7	1	1/19/07	9:30 A.M.	2	P.D.O.	1	1	2	4	4/—	BOTH VEH. S.B. ON OLD WOLF RD. V2 STOPPED, V1 DID NOT. (RE.)
	2	1/21/07	12:10 A.M.	2	P.I.	4	1	1	1	7/—	V1 W.B. ON A.S.R., V2 E.B. V1 TURNED LT. I.F.O V2 @ I-87 RAMP. (L.T.)
	3	1/24/07	7:41 A.M.	3	P.D.O.	1	1	1	2	66/-/—	V1 S.B. ON OLD WOLF RD., V2 & 3 W.B. ON A.S.R. IN LT.L. BEHIND "UNINVOLVED" @ SIGNAL. V1 TURNED LT. + FISH TAILED INTO V1+V2 (L.T.)
	4	2/5/07	5:36 P.M.	2	P.I.	4	1	1	2	—/17,18	V1 E.B. ON A.S.R., V2 W.B. V2 TURNED LT. I.F.O V1 @ I-87 ON-RAMP. (L.T.)
	5	3/26/07	2:37 P.M.	3	P.I.	1	1	2	3	3,66/—	ALL 3 VEH. S.B. ON OLD WOLF RD. V2+3 STOPPED FOR TRAFFIC @ SIGNAL, V1 DID NOT. V1 STRUCK V2+PUSHED V2 INTO V3. (RE.)
	6	4/10/07	4:20 P.M.	2	P.D.O.	1	1	1	1	18/18	BOTH VEH. S.B. ON OLD WOLF RD., V2=LT.L., V1 IN CENTER LT (TURN) LN. DURING TURN, V1 MOVED INTO V2'S (O.T.)
	7	5/14/07	P.M.	2	P.I.						BOTH VEH. S.B. ON OLD WOLF RD. V1 STOPPED FOR SIGNAL @ A.S.R. V2 DID NOT. (RE.)
	8	6/14/07	3:16 P.M.	2	P.D.O.	1	1	1	1	26,17/—	V1 W.B. ON A.S.R., V2 E.B. V1 TURNED LT. I.F.O V2 IN EB LN. (L.T.)
	9	8/18/07	8:01 A.M.	2	P.I.	1	1	1	1	17/—	V1 S.B. ON OLD WOLF RD., V2 W.B. ON A.S.R. V1 RAN SIGNAL I.F.O V2. (L.T.)
	10	9/29/07	8:10 P.M.	2	P.I.	1					BOTH VEH. E.B. ON A.S.R. IN RT.L., BOTH TURNING ONTO I-87 RAMP. V1 STOPPED W/O WARNING IN TURN, V2 COULD NOT AVOID V1. (RE.)
	11	10/7/07	P.M.	2	P.D.O.						BOTH VEH. E.B. ON A.S.R. V1 STOPPED @ SIGNAL, V2 DID NOT. (RE.)
	12	10/26/07	12:40 P.M.	2	P.D.O.	1	1	1	1	7/18	BOTH VEH. S.B. ON OLD WOLF RD., STOPPED @ SIGNAL. WITH GREEN LIGHT TURNED GREEN, V2 STARTED, THEN STOPPED W/O CAUSE V1 DID NOT STOP (RE.)
	13	12/7/07	3:41 P.M.	2	P.I.	1	1	2	2	42/—	BOTH VEH. S.B. ON OLD WOLF RD. V2 STOPPED IN TRAFFIC; GPI "BLIPPED" BY SUN GLARE, DIDN'T KNOW V2 STOPPED. (R.E.)
	14	4/11/08	6:54 A.M.	3	P.D.O.	1	1	2	3	66/-/—	ALL 3 VEH. S.B. ON OLD WOLF RD, IN R.T.L. V2+3 STOPPED BUT V1 SLID INTO V2 PUSHING V2 INTO V3. (RE.)
	15	1/14/08	4:01	2	P.D.O.	1	1	1	1	42/—	BOTH VEH. S.B. ON OLD WOLF RD. V2 STOPPED; V1'S BRAKES FAILED. (RE.)

TE 213 (9/79)

DIAGRAM NO. 3

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 3 OF 3

COUNTY ALBANY — ~~P.I.N.~~ OR IDENT. 1 1 0 4 9 5

☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME: ALBANY SHAKER ROAD. (N.Y. 155)

AT INTERSECTION WITH/OR BETWEEN: OLD WOLF ROAD (N.Y. 155) & I-87 S.B. ON-RAMP

CASE NO. 1090278
FILE D.M.V.
BY D.T.W.
DATE 1/13/10

TIME PERIOD — NUMBER OF MONTHS: 36 — FROM 1/1/07 TO 12/31/09

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	⑪ DESCRIPTION
17	12/17/08	1:40 P.M.	2	PDO	1	1	4	1		BOTH VEH. MAKING RT. TURN FROM A.S.R. E.B. ONTO I-87 S.B. RAMP. V1 STOPPED WHILE OP 2 CHECKING APPROACHING TRAFFK. (RE)
18	1/12/09	7:42 P.M.	2	P.I.	4	1	4	1	7/—	V1 W.B. ON A.S.R., V2 E.B. V1 TURNED LT. TO I-87 RAMP, I.F.O. V2. (L.T.)
19	1/12/09	3:01 P.M.	1	PDO.	1	1	1	1	4	V1 S.B. ON OLD WOLF RD., PREPARING TO TURN RT. ONTO A.S.R. V1 TURNED TOO SOON & STRUCK CURB & SIGN ON RT. (F.O.)
20	4/14/09	6:50 PM	2	PDO.	1	1	1	1	4/—	BOTH VEH. E.B. ON A.S.R. IN RT. LN FOR RAMP. V2 STOPPED & OP1 DIDN'T LOOKING. (R.E.)
21	9/11/09	8:07 P.M.	2	PDO.	4	1	2	2	7/—	V1 W.B. ON A.S.R., V2 E.B. V1 TURNED LT. TO I-87 RAMP, I.F.O. V2. (L.T.)

ACCIDENT SUMMARY SHEET

MUNICIPALITY Town of Colonie COUNTY Albany

LOCATION NY 910B; RM 910B-1101-1016 TO 1019 ~~HSI #~~ PIN 1721.51

TIME PERIOD 1/1/07 to 3/31/10 NO. OF MONTHS 39

Accident Type	No. of Accidents
Right Angle	17
Rear End	66
Overtaking	14
Left Turn	34
Sideswipe/Head-on	
Right Turn	1
Parked Vehicle	
Pedestrian	
Bicycle	
Animal	
Fixed Object	
w/Utility Poles	
w/Guide Rail	
w/Sign Posts	
w/Trees	
w/Ditch-Embank.	
w/	
TOTAL	132

Pavement	No. of Accidents	
Dry	97	
Wet	25	(20% of known)
Snow/Ice	5	(4% of known)
Unknown	5	
TOTAL	132	

Weather	No. of Accidents
Clear	68
Cloudy	46
Rain	9
Snow	3
Sleet	
Fog	1
Unknown	5
TOTAL	132

Light Conditions	No. of Accidents
Day	85
Night	46
Unknown	1
TOTAL	132

Accident Severity	No. of Accidents
Fatal	
Injury	52
Property Damage	80
TOTAL	132

Program: sass1701

NYSDOT Safety Information Management System
Accident Severity Summary
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

Date: 02/14/11 14:32

Route: 910B Highway Location Ref Mrkr Range: 910B11011016 - 910B11011019

Dates: 01-JAN-2007 thru 31-MAR-2010 Traffic Volume: 29,180

Total of Fatal Accd	Total of Injury Accd	Total of PDO Accd	Total of Non-Reportable	Total Number of Accidents	Accident Rate
0	59	61	11	131	9.46

Accident rate for linear section is accidents per million vehicle miles.

NYSDOT Safety Information Management System
Summary Report By Segment And/Or Intersection
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

ROUTE: 910B HIGHWAY LOCATION: 910B11011016 - 910B11011019 DATES: 01-JAN-2007 - 31-MAR-2010

REFERENCE	INT.	DESCRIPTION	NUMBER OF ACCIDENTS										LIGHT CONDITION		
			TOTAL	FTL	INJ	PDO	N/R	WET ROAD **	FIXED OBJ **	PED& BIKE **	TRUCK *** **		DWN/DSK **	DAY **	NIGHT **
910B 1101 1016			4	0	3	1	0	2	0	0	0		1	3	0
910B 1101 1016	45	MARCUS BLVD	3	0	2	1	0	0	0	0	0		1	1	1
910B 1101 1017			10	0	4	5	1	1	0	0	0		0	5	5
910B 1101 1017	40	ULENSKIE DR	4	0	1	3	0	2	1	0	0		1	1	2
910B 1101 1018			16	0	6	7	3	3	0	0	0		0	10	5
910B 1101 1018	41	RAMP FROM I87 NB - EXIT 4	9	0	4	2	3	2	0	0	1		2	5	2
910B 1101 1019			1	0	0	1	0	0	0	0	0		0	1	0
910B 1101 1019	42	ALBANY SHAKER RD & RAMP TO I87 NB	84	0	39	41	4	15	0	0	2		2	55	23
		ROUTE TOTAL EXCLUDES 999 RMS	131	0	59	61	11	25	1	0	3		7	81	38

** EXCLUDES PARTIALLY CODED NON-REPORTABLES

*** EXCLUDES PICKUPS & VANS

TE 56 (4/69)

DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING AND SAFETY DIVISION
COLLISION DIAGRAM

1 of 2

1080 248

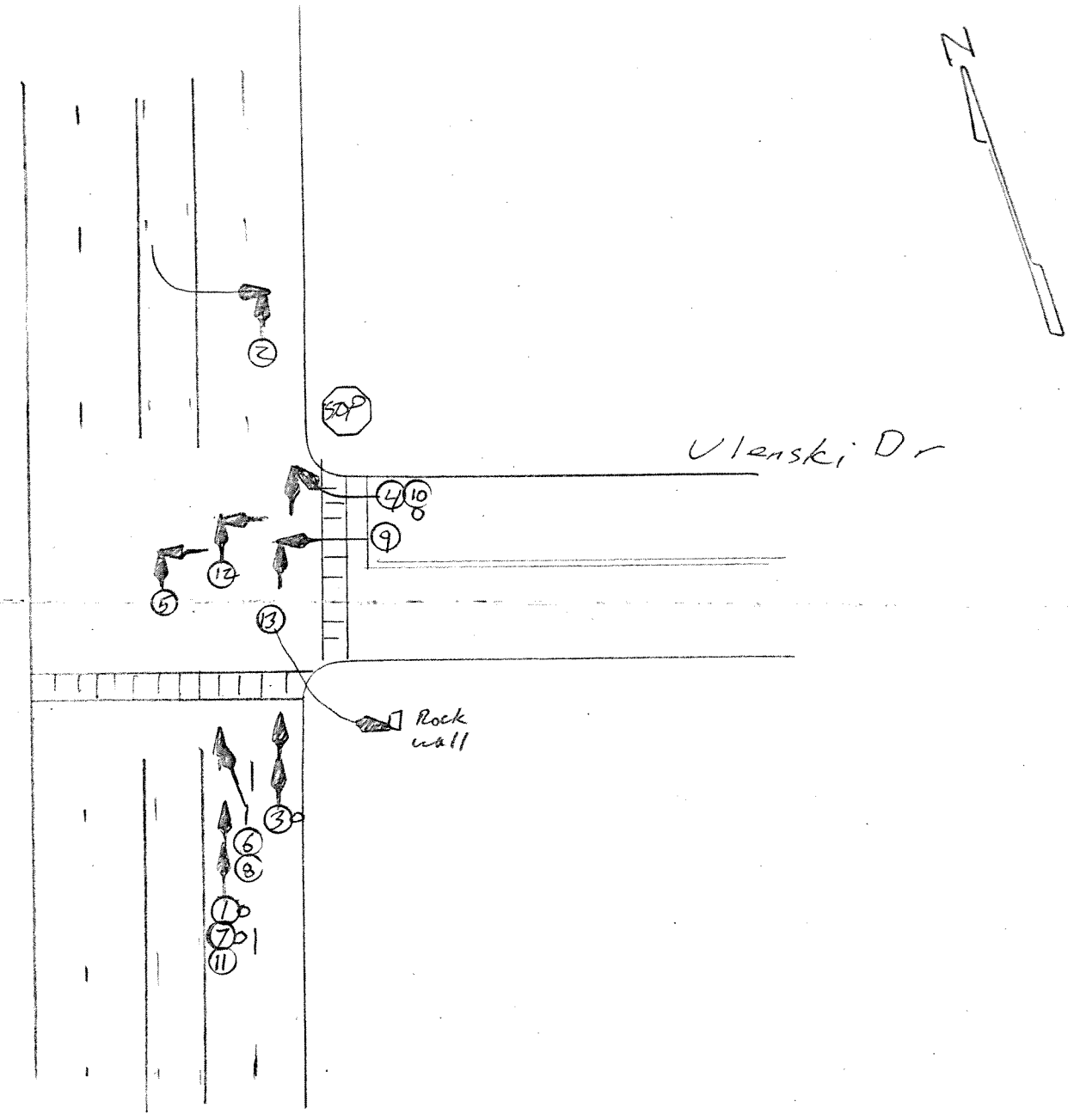
Municipality Town of Colonie County Albany

Intersection Wolf Rd @ Ulenski Dr 9103-1101-1017

Period 3 Years 9 Months From 1/1/05 To 9/28/08

File

By Pwm Date 10/2/0



SYMBOLS		MANNER OF COLLISION	
Moving Vehicle	Pedestrain	Rear-end	Head-on
M—Motorcycle	B—Bicycle	Side-swipe	
Backing Vehicle	Fixed Object	Out of control	Left-turn
Stopped Vehicle	Personal Injury	Skidding	
Parked Vehicle	Fatal Injury	Overturned	Right-angle

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. ____

COUNTY Allegany P.I.N. OR IDENT. ☐☐☐☐☐

☑ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: Wolf Road

AT INTERSECTION WITH/OR BETWEEN: Ulenski Dr 91013-1101-1017

CASE NO. 1080248
FILE ____
BY Qum
DATE 10/2/08

TIME PERIOD NUMBER OF MONTHS: 1 — FROM 1/1/05 TO 9/28/08

ENVIRONMENTAL Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	⑪ DESCRIPTION
					Use Codes from MV 104 Police Report — see back of this form for codes					
1	1/7/05	5:58 PM	2	PI	1	1	1	1	9	Stopped in traffic
2	12/23/05	12:15 PM	2	PDO	1	1	1	2	7	operator was waved across by uninvolved motorist
3	3/20/06	6:56 PM	2	PI	4	1	1	1	4	pedestrian had just crossed roadway 2nd veh-inattention
4	3/29/06	1:22 PM	2	PDO	1	1	1	1	4,7	
5	4/7/06	5:12 PM	2	PDO	1	2	2	3	7,13	Operator waved out by uninvolved motorist, veh driving up turn lane
6	8/9/06	4:31 PM	3	PDO	1	1	1	1	4	inattention during lane change
7	9/7/06	4:37 PM	2	PI	1	1	1	1	4	inattention
8	4/17/07	4:47 PM	2	PDO	1	1	1	2	20	
9	9/8/07	8:04 PM	2	PDO	4	1	2	3	7	vision impored due to heavy rain
10	9/23/07	6:39 PM	2	PI	3	1	1	1	7	
11	11/26/07	4:18 PM	2	PDO	4	1	2	3	4	inattention
12	11/27/07	9:55 AM	2	PDO	1	1	2	2	7	waved out by uninvolved motorist
13	12/2/07	3:01 AM	1	PDO	4	1	1	2	2,19	ALCOHOL

ACCIDENT SUMMARY SHEET

MUNICIPALITY Town of Colmie COUNTY Albany

LOCATION AC Route 153 / Old Wolf Rd PIN ~~HSI #~~ 1721.51

TIME PERIOD 1/1/07 TO 3/31/10 NO. OF MONTHS 39

Accident Type	No. of Accidents	
Right Angle	6	
Rear End	12	
Overtaking	1	
Left Turn	8	
Sideswipe/Head-on		
Right Turn		
~~Parked Vehicle~~ Backing	1	
Pedestrian		
Bicycle	1	
Animal		
Fixed Object	1	
w/Utility Poles-Wires		1
w/Guide Rail		
w/Sign Posts		
w/Trees		
w/Ditch-Embank.		
w/		
TOTAL	30	

Pavement	No. of Accidents
Dry	20
Wet	7
Snow/Ice	1
Unknown	2
TOTAL	30

Weather	No. of Accidents
Clear	19
Cloudy	7
Rain	2
Snow	
Sleet	
Fog	
Unknown	2
TOTAL	30

Light Conditions	No. of Accidents
Day	22
Night	7
Unknown	1
TOTAL	30

Accident Severity	No. of Accidents
Fatal	0
Injury	13
Property Damage	17
TOTAL	30

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. NONE

COUNTY Albany ☑ TOWN ☐ CITY ☐ VILLAGE OF Colonie

P.I.N. OR IDENT. 1721 51

ROUTE NO. OR STREET NAME: Albany County Route 153/Old Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: THRM 155 - 1101 - 3048 TO 3052

CASE NO.
FILE ALIS
BY MED
DATE 2/4/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL
Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS (Use Codes from MV 104 Police Report — see back of this form for codes)	TH RM	⑪ DESCRIPTION
1	1/2/07	5:18P	2	PDO	5	1	1	1	4,9	3048	REAR END- SB, V-1 STOPPED IN TRAFFIC
2	2/20/07	5:32P	2	PDO	4	1	4	1	7,64	3048	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK SB V-2
3	5/30/07	8:39A	2	PI-2	1	1	1	1	7	3048	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
4	8/9/07	5:31P	2	PI-2	1	1	1	1	13	3048	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
5	9/5/07	4:10P	2	PI-2	1	1	1	1	7	3048	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
6	10/17/07	4:59P	2	PDO	1	1	1	1	4	3048	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
7	12/5/07	1:45P	2	PDO	1	1	2	2	4,20	3048	OVERTAKE-SB, V-1 CHANGED LANES
8	12/19/07	4:12P	2	PI-1	3	1	2	2	7	3019	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
9	2/3/07	10:45A	2	PI-1	1	4	2	1	9	3050	REAR END-WB, V-2 STOPPED IN TRAFFIC AT SIGNAL
10	2/13/07	8:02A	2	PDO	1	1	1	2	9	3050	REAR END-WB, HEAVY TRAFFIC ON RAMP SLOWING FOR SIGNAL
11	2/13/07	8:17A	3	PDO	1	1	1	2	9	3050	REAR END-WB, HEAVY TRAFFIC ON RAMP SLOWING FOR SIGNAL
12	5/14/07	P	2	PI-1						3050	REAR END-SB, V-1 STOPPED FOR RED TRAFFIC SIGNAL
13	11/7/07	7:53A	2	PI-1	1	1	1	1	4	3050	REAR END-SB, V-2 STOPPED IN TRAFFIC AT SIGNAL
14	9/10/07	9:18A	2	PI-1	1	1	2	2	3	3052	NB V-1 BACKED SB, STRUCK V-2 STOPPED NB
15	9/20/07	9:16A	1	PDO	1	1	1	1	45	3052	V-1 NB W/ DUMP UP, STRUCK UTILITY WIRES
16	1/19/08	5:00P	2	PI-1	4	1	1	1	7,18	3019	RIGHT ANGLE, V-1 ENTERED TRAFFIC SB, STRUCK BY SB V-2

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. NONE

SHEET 2 OF 2

COUNTY Albany ~~OR IDENT.~~ P.I.N. 172151

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: CR 153 / Old Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: TH RM 155-1101-3048 TO 3052

CASE NO.
FILE ALIS
BY MED
DATE 2/11/11

TIME PERIOD: NUMBER OF MONTHS 39 FROM 1/1/07 TO 3/31/10

ENVIRONMENTAL: Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	TH RM	⑪ DESCRIPTION
17	4/23/08	8:01A	2	PI-1	1	1	1	1	7,69	3048	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
18	7/10/08	12:31P	2	PDO	1	1	1	1	7	3048	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
19	1/17/08	5:17P	2	PDO	3	1	1	2	4,9	3049	REAR END-SB, V-2 STOPPED IN TRAFFIC
20	4/30/08	8:00A	2	PDO	1	1	1	1	9,4	3050	REAR END-WB, V-2 SLOWING IN TRAFFIC AT SIGNAL
21	8/11/08	4:44P	2	PDO	1	1	2	3	66	3050	REAR END-WB, V-1 STARTING IN TRAFFIC AT SIGNAL
22	4/24/09	5:29P	2	PI-2	1	1	1	1	13,17	3048	NB V-2 ATTEMPTED LEFT TURN, STRUCK BY SB V-1
23	6/25/09	5:23P	2	PDO	1	1	1	1	7	3048	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
24	9/2/09	12:56P	2	PDO	1	1	1	1	7	3048	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
25	12/16/09	5:30P	2	PDO	4					3048	NB V-1 ATTEMPTED LEFT TURN, STRUCK SB V-2
26	5/31/09	4:50P	2	PDO	1	1	1	1	17,9	3050	REAR END-SB, V-2 STOPPED AT RED TRAFFIC SIGNAL
27	8/29/09	6:25P	2	PI-2	3	1	2	2	7	3050	REAR END-WB, V-2 SLOWING IN TRAFFIC AT SIGNAL
28	9/4/09	10:35A	2	PDO	1	1	1	1	26,4	3050	REAR END-SB, BOTH VEHS PULLING TO SHOULDER FOR EMERG. VEH
29	4/10/09	6:37P	2	PDO	1	1	1	1		3051	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
30	3/22/10	2:20P	1	PI-1	1	1	2	3	10	3048	V-1 STOPPED IN TRAFFIC SB, SB BICYCLIST HAD SIEZURE

ACCIDENT SUMMARY SHEET

MUNICIPALITY Town of Colmie COUNTY Albany

LOCATION AC Route 151 / Albany-Shaker Rd PIN ~~HSI #~~ 1721.51

TIME PERIOD 1/1/07 to 3/31/10 NO. OF MONTHS 39

Accident Type	No. of Accidents	
Right Angle	8	
Rear End	23	
Overtaking	10	
Left Turn	11	
Sideswipe/Head-on	1	
Right Turn		
Parked Vehicle		
Pedestrian		
Bicycle		
Animal		
Fixed Object	2	
w/Utility Poles		
w/Guide Rail		1
w/Sign Posts		1
w/Trees		
w/Ditch-Embank.		
w/		
TOTAL	55	

Pavement	No. of Accidents	
Dry	38	
Wet	12	(23% of known
Snow/Ice	2	(4% of known
Unknown	3	
TOTAL	55	

Weather	No. of Accidents
Clear	30
Cloudy	12
Rain	7
Snow	3
Sleet	
Fog	
Unknown	3
TOTAL	55

Light Conditions	No. of Accidents
Day	42
Night	12
Unknown	1
TOTAL	55

Accident Severity	No. of Accidents
Fatal	—
Injury	21
Property Damage	34
TOTAL	55

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. NONE

COUNTY Albany P.I.N. OR IDENT. 1721151

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: Albany County Route 151 / Albany Shaker Rd

AT INTERSECTION WITH/OR BETWEEN: TH RM 155-1101-3038 TO 3047+

CASE NO.
FILE ALIS
BY MED
DATE 2/22/11

TIME PERIOD
NUMBER OF MONTHS 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	TH RM	⑪ DESCRIPTION
1	3/12/07	6:07P	2	PDO	1	1	2	1	7	3046	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
2	6/19/07	6:12P	2	PDO	1	1	1	2	18	3046	OVERTAKE - WB, V-1 CHANGED LANES
3	1/19/07	9:30A	2	PDO	1	1	2	4	4	3047	REAR END - SB, V-2 STOPPED IN TRAFFIC AT SIGNAL
4	1/21/07	[illegible]:10A	2	PI-2	4	1	1	1	7	3047	WB V-1 ATTEMPTED LEFT TURN, STRUCK EB V-2, AT SIGNAL
5	1/24/07	7:41A	3	PDO	1	1	1	2	66	3047	RIGHT ANGLE SB V-1 MAKING LEFT, STRUCK V-2 STOPPED WB
6	2/5/07	5:36P	2	PI-2	4	1	1	2	7,18	3047	WB V-2 ATTEMPTED LEFT STRUCK BY EB V-1 AT SIGNAL
7	3/26/07	2:37P	3	PI-1	1	1	2	3	9,6	3047	REAR END - SB, V-3 STOPPED, V-2 SLOWING, V-1 STRUCK V-2
8	4/10/07	4:20P	2	PDO	1	1	1	1	18,18	3047	OVERTAKE - SB, BOTH VEHICLES MAKING LEFT TURNS
9	6/14/07	3:16P	2	PDO	1	1	1	1	26,17	3047	WB V-1 ATTEMPTED LEFT AGAINST SIGNAL, STRUCK BY EB V-2
10	8/18/07	8:01A	2	PI-1	1	1	1	1	17	3047	RIGHT ANGLE, SB V-1 PASSED RED SIGNAL, STRUCK WB V-2
11	9/20/07	3:10P	2	PI-1	1					3047	REAR END - EB, V-1 SLOWING TO MAKE RIGHT, AT SIGNAL
12	10/7/07	P	2	PDO	1	1	1	1		3047	REAR END - EB, V-1 SLOWING IN TRAFFIC AT RED SIGNAL
13	10/26/07	12:40P	2	PDO	1	1	1	1	7	3047	REAR END SB, V-2 STOPPED IN TRAFFIC AT SIGNAL
14	12/17/07	3:41P	2	PI-1	1	1	2	2	6,2	3047	REAR END SB, V-2 STOPPED IN TRAFFIC AT SIGNAL
15	1/11/07	5:21P	2	PDO	3	1	1	1	9		REAR END - WB, V-2 SLOWING IN TRAFFIC
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]

TE 213 (9/79)

DIAGRAM NO. NONE

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

COUNTY Albany P.I.N. OR IDENT. 1 7 2 1 5 1

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: AC Route 151 / Albany-Shaker Rd

AT INTERSECTION WITH/OR BETWEEN: TH RM 155-1101-3038 TO 3047+

CASE NO.
FILE ALIS
BY MED
DATE 2/22/11

TIME PERIOD
NUMBER OF MONTHS 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry 4. Snow/Ice
2. Wet 5. Slush
3. Muddy 10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	TH RM	⑪ DESCRIPTION
17	9/7/07	5:36P	2	PDO	1	1	1	1	7		RIGHT ANGLE, V-1 ENTERED TRAFFIC NB, STRUCK BY EB V-2
18	11/2/07	12:27P	2	PDO	1	1	1	2	20		OVERTAKE-EB, V-1 CHANGED LANES
19	10/8/08	9:19P	2	PDO	4	1	2	3	17,18	3040	RIGHT ANGLE, V-1 PULLED SB FROM VIEWING LOT IFO WB V-2
20	12/19/08	4:47P	2	PI-1	4	1	4	4	2,17,69	3042	WB V-1 CROSSED CENTERLINE, STRUCK EB V-2 HEAD ON
21	7/3/08	8:17A	2	PDO	1	1	1	1	4,9	3044	REAR END-WB, V-2 STOPPED IN TRAFFIC
22	7/22/08	5:10P	3	PI-2	1	4	2	3	4	3044	REAR END-EB, V-2 AND V-3 STOPPED IN TRAFFIC
23	1/3/08	4:19P	2	PDO	1	1	1	1	4	3046	REAR END-WB, V-2 STOPPED TO MAKE LEFT
24	4/16/08	5:17P	3	PI-1	1	1	1	1	4	3046	REAR END-WB, BOTH VEHICLES SLOWING IN HEAVY TRAFFIC
25	5/13/08	4:21P	2	PI-1	1	1	1	1	7	3046	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
26	6/[illegible]/08	[illegible]P	2	PI-1	1	1	1	1	7	3046	RIGHT ANGLE, V-1 ENTERED TRAFFIC NB, STRUCK BY EB V-2
27	6/19/08	2:08P	2	PDO	1	1	1	2	7,69	3046	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
28	7/27/08	11:43A	2	PI-2	1	1	1	2	20	3046	OVERTAKE-WB, V-1 CHANGED LANES TO AVOID UNINVOLVED VEH
29	10/31/08	4:26P	2	PI-1	1	1	1	1	4,13	3046	OVERTAKE-WB, V-1 CHANGED LANES
30	11/23/08	12:16P	3	PI-1	1	1	1	1	4,20	3046	OVERTAKE-WB, V-1 CHANGED LANES, STRUCK V-2
31	2/12/08	7:45A	2	PDO	1					3047	OVERTAKE-EB, V-2 CHANGED LANES
32	4/11/08	8:54A	3	PDO	1	1	2	2	4		REAR END-EB, V-2 AND V-3 STOPPED IN TRAFFIC

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. NONE

SHEET 3 OF 4

COUNTY Albany ~~OR IDENT.~~ P.I.N. 172151

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: AC Route 151 / Albany-Shaker Rd

AT INTERSECTION WITH/OR BETWEEN: TH RM 55-1101-3038 TO 3047+

CASE NO.
FILE ALIS
BY MED
DATE 2/22/11

TIME PERIOD: NUMBER OF MONTHS 39 FROM 1/1/07 TO 3/31/10

ENVIRONMENTAL: Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	TH RM	⑪ DESCRIPTION
33	6/10/08	4:01P	2	PDO	1	1	1	1	42	3047	REAR END-SB, V-2 STOPPED IN TRAFFIC AT SIGNAL
34	8/29/08	10:10A	2	PDO	1	1	1	2		3047	RIGHT ANGLE, SB V-1 MAKING LEFT, STRUCK V-2 STOPPED WB AT SIGNAL
35	11/13/08	12:18P	2	PDO	1	1	2	3		3047	REAR END-EB, V-1 STOPPED FOR EMERGENCY VEHICLE
36	12/17/08	1:40P	2	PDO	1	4	1	1		3047	REAR END-EB, V-1 STARTED ROR, STOPPED AGAIN
37	1/10/08	6:41A	2	PI-1	2	1	1	2	20		OVERTAKE-WB, V-1 SWERVED TO AVOID UNINVOLVED VEH
38	2/9/08	8:16P	2	PDO	4	1	2	3	20,7		OVERTAKE-EB, V-1 CHANGED LANES
39	4/10/08	8:28A	2	PDO	1	1	1	1	4,9		REAR END-WB, V-2 STOPPED IN TRAFFIC
40	5/20/09	12:33P	2	PI-1	1	4	1	1	7,13	3040	RIGHT ANGLE, V-1 PULLED SB FROM VIEWING LOT IFO WB V-2
41	11/5/09	5:44P	2	PDO	5	4	2	3	4	3041	OVERTAKE-EB, V-2 CHANGED LANES
42	4/7/09	P	2	PDO	1	1	1	1		3042	REAR END-EB, V-1 STRUCK V-2 IN STOP & GO TRAFFIC
43	6/10/09	P	2	PI-1						3045	REAR END-EB, V-1 SLOWING IN TRAFFIC
44	7/30/09	5:18P	2	PI-1	1	1	1	1	9	3046	REAR END-EB, V-2 SLOWING IN TRAFFIC
45	9/8/09	11:28A	2	PI-1	1	1	1	1	9	3046	REAR END-WB, V-2 STOPPED IN TRAFFIC
46	9/15/09	4:15P	2	PI-1	1	1	1	1	7,69	3046	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
47	1/12/09	7:42P	2	PI-1	4	1	1	1	7	3047	WB V-1 ATTEMPTED LEFT TURN AT SIGNAL, STRUCK BY EB V-2
48	[illegible]	[illegible]	1	PDO	1	1	1	1	4	[illegible]	[illegible]

TE 213 (9/79)

DIAGRAM NO. NONE

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 4 OF 4

COUNTY Albany ☒ TOWN ☐ CITY ☐ VILLAGE OF Colonie

P.I.N. OR IDENT. 1 7 2 1 5 1

ROUTE NO. OR STREET NAME: AC 151 / Albany-Shaker Rd

AT INTERSECTION WITH/OR BETWEEN: TA RM 155-1101-3038 TO 3047

CASE NO.

FILE A215

BY MED

DATE 2/22/11

TIME PERIOD — NUMBER OF MONTHS: 39 — FROM 1/1/07 TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	TH RM	⑪ DESCRIPTION
49	4/14/09	4:50P	2	PDO	1	1	1	1	4	3047	REAR END-EB, V-2 STOPPED IN TRAFFIC AT SIGNAL
50	6/29/09	5:50P	2	PDO	1	4	1	2	9	3047	REAR END-EB, V-2 STARTED TURN, THEN STOPPED, AT SIGNAL
51	9/11/09	8:07P	2	PDO	4	1	2	2	7	3047	WB V-1 ATTEMPTED LEFT TURN AT SIGNAL, STRUCK BY EB V-2
52	1/28/10	9:01A	1	PDO	1	1	4	2	66	3044	EB V-1 SLID ON ICY PAVEMENT, STRUCK GR
53	2/2/10	6:57P	2	PDO	4	1	2	4	7	3046	RIGHT ANGLE, V-1 ENTERED TRAFFIC NB, STRUCK BY EB V-2
54	2/17/10	6:11P	2	PDO	4	1	1	1	7	3046	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
55	1/22/10	8:53P	2	PDO	4	1	1	1	7	3047	WB V-1 ATTEMPTED LEFT AT SIGNAL, STRUCK BY EB V-2

Program: sass1701

NYSDOT Safety Information Management System
Accident Severity Summary
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

Date: 02/14/11 14:32

Route: 910B Highway Location Ref Mrkr Range: 910B11011010 - 910B11011015

Dates: 01-JAN-2007 thru 31-MAR-2010 Traffic Volume: 30,260

Total of Fatal Accd	Total of Injury Accd	Total of PDO Accd	Total of Non-Reportable	Total Number of Accidents	Accident Rate
0	21	26	5	52	2.41

Accident rate for linear section is accidents per million vehicle miles.

Program: sass1704

NYSDOT Safety Information Management System
Summary Report By Segment And/Or Intersection
Intersection & Non-Intersection Accidents
Complete Accident Data From NYSDMV Is Only Available thru 30-SEP-2010

Date: 02/14/11 14:32

ROUTE: 910B HIGHWAY LOCATION: 910B11011010 - 910B11011015 DATES: 01-JAN-2007 - 31-MAR-2010

REFERENCE	INT.	DESCRIPTION	NUMBER OF ACCIDENTS											
			TOTAL	FTL	INJ	PDO	N/R	WET ROAD **	FIXED OBJ **	PED& BIKE **	TRUCK *** **	LIGHT CONDITION DWN/DSK **	DAY **	NIGHT **
910B 1101 1010			7	0	3	4	0	2	0	1	0	0	6	1
910B 1101 1010	36	COMPUTER DR	11	0	4	5	2	3	0	0	0	0	11	0
910B 1101 1011			7	0	2	4	1	0	0	0	0	0	6	1
910B 1101 1011	37	WOLF ROAD SHOPPERS PARK	2	0	1	1	0	0	0	0	0	0	1	1
910B 1101 1012			4	0	2	1	1	1	0	0	0	0	4	0
910B 1101 1013			6	0	2	4	0	5	0	0	0	0	4	1
910B 1101 1013	39	METRO PARK RD	6	0	4	2	0	1	0	0	0	0	5	1
910B 1101 1014			2	0	0	2	0	0	0	0	0	0	1	1
910B 1101 1014	44	BELTRONE DR	2	0	1	1	0	1	0	0	0	0	2	0
910B 1101 1015			4	0	2	2	0	1	0	0	0	0	3	1
		ROUTE TOTAL EXCLUDES 999 RMS	51	0	21	26	4	14	0	1	0	0	43	7

** EXCLUDES PARTIALLY CODED NON-REPORTABLES

*** EXCLUDES PICKUPS & VANS

ACCIDENT SUMMARY SHEET

MUNICIPALITY Town of Colonie COUNTY Albany

LOCATION NY 910 B; RM 910B - 1101 - 1010 to 1015 PIN ~~HSI #~~ 1721.51

TIME PERIOD 1/1/07 to 3/31/10 NO. OF MONTHS 39

Accident Type	No. of Accidents
Right Angle	22
Rear End	20
Overtaking	7
Left Turn	3
Sideswipe/Head-on	1
Right Turn	
Parked Vehicle	
Pedestrian	1
Bicycle	
Animal	
Fixed Object	
w/Utility Poles	
w/Guide Rail	
w/Sign Posts	
w/Trees	
w/Ditch-Embank.	
w/	
TOTAL	54

Pavement	No. of Accidents
Dry	39
Wet	14
Snow/Ice	
Unknown	1
TOTAL	54

Weather	No. of Accidents
Clear	23
Cloudy	20
Rain	9
Snow	1
Sleet	
Fog	
Unknown	1
TOTAL	54

Light Conditions	No. of Accidents
Day	45
Night	9
Unknown	
TOTAL	54

Accident Severity	No. of Accidents
Fatal	
Injury	20
Property Damage	34
TOTAL	54

TE 156a (3/76)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION
HIGHWAY SAFETY
INVESTIGATION REPORT
(SEE INSTRUCTIONS ON REVERSE)

MAIN OFFICE USE:
DIVISION FILE
REVIEWED BY
SCHEDULED FOR B&A ☐

1. LOCATION

IDENT. NO.: 1 1 0 4 7 7

☑ TOWN ☐ CITY ☐ VILLAGE } OF Colonie

ROUTE NO. OR STREET NAME	STATE HIGHWAY NO.	FROM OR AT REFERENCE MARKER
NY 910B / Wolf Rd		9 1 0 B 1 1 0 1 1 0 1
At Intersection With (If Applicable)	**ROUTE NO. OR STREET NAME**	**STATE HIGHWAY NO.**	**TO REFERENCE MARKER**
	CR 151 / Albany Shaker Road		9 1 0 B 1 1 0 1 1 0 1

2. REASON FOR INVESTIGATION
- ☒ (a) IDENTIFIED BY ACCIDENT SURVEILLANCE SYSTEM
- ☐ (b) POLICE HAZARD REPORT
- ☒ (c) RESPONSE TO COMPLAINT OR INQUIRY PIN 1721.51
- ☒ (d) REGIONALLY INITIATED ARWP
- ☐ (e) OTHER (Explain) _____

3. RECOMMENDATION
- ☐ (a) CAPITAL IMPROVEMENT (Initiate Proj. Devel. Study)
- ☐ (b) TRAFFIC CONTROL IMPROVEMENT
- ☐ (c) MAINTENANCE IMPROVEMENT
- ☐ (d) OTHER
- ☒ (e) NONE

} complete sections 4 & 5

4. DISCUSSION (Use reverse if additional space is required – check box if reverse is used ☐)

(a) PROBLEMS IDENTIFIED

See attached Page 2 of 2

(b) PROPOSED SOLUTION

	Reduction Index	Severity Rank
2009 PIL Rm 1016 TO 1019	66.52	16.00
2009 PII Rm 1019	42.88	42.69

(c) ACTION TAKEN

5. ACCIDENT EXPERIENCE

Number of Months	PERIOD BEGINNING		NUMBER OF ACCIDENTS		
	MONTH	YEAR	Fatal Accidents	Injury Accidents	Property Damage Accidents
1 0	0 1	0 7	0	10	10
2 4	1 1	0 7	0	33	57
0 5	1 1	0 9	0	9	13

6. BENEFIT/COST ANALYSIS (see instructions)

Check box if Benefit/Cost Calculations are attached ☐

PRINCIPAL INVESTIGATOR: Michael E Dody | TITLE: CE II

APPROVED BY: [signature] | DATE: 3-3-11

Problems Identified

NY Route 910B, Wolf Road, was identified as a Priority Investigation Location (PIL) from RM 1016 to 1019 and a Priority Investigation Intersection (PII) at RM 1019 based on reportable accidents during the period 11/1/07 to 10/31/09. NY 910B, which travels north-south, is a four lane divided Urban Principal Arterial highway with free access. The travel way is 54 feet wide, which accommodates four lanes and a paved flush median that provides refuge for turning vehicles. This area is commercially developed with various businesses and driveways on both sides of the roadway. Pavement markings and signing are satisfactory. The posted speed limit is 40 MPH.

Northbound, NY 910B is intersected by Marcus Boulevard from the east at RM 1016 in a T-intersection controlled by a three color traffic signal. NY 910B is intersected by Ulenskie Drive from the east at RM 1017 in a stop controlled T-intersection. NY 910B is intersected at RM 1018 by the I87 NB Exit 4 off ramp from the west in a T-intersection controlled by a 3 color traffic signal. NY 910B is intersected by Albany Shaker Road at RM 1019 in an intersection controlled with a fully detected three color traffic signal. NY 910B ends at the intersection and the I87 Exit 4 NB on ramp continues north.

The accident study period was 39 months, 1/1/07 to 3/31/10. Based on the 132 accidents that occurred during the study period the accident rate is 9.46 ACC/MVM. This rate is greater than the expected accident rate of 3.59 ACC/MVM for similar highways statewide. There were 90 accidents during the 2 year HAL period. The majority of the accidents consisted of rear end, overtaking, and turning accidents due to traffic congestion, generally grouped around the intersections. There were no accidents involving pedestrians or bicyclists. Of the 127 accidents on this section of highway with pavement condition reported, 25 (20%) occurred on wet pavement and 5 (4%) on snow/ice/slush pavements. There were 11 accidents during the morning peak from 6 am to 9 am and 34 accidents during the evening peak from 3 pm to 6 pm.

A signal study was recently performed at the intersection with Ulenskie Drive at RM 1017. Case #1080248, completed 12/28/08, resulted in no safety recommendation.

Proposed Solution

There is a project, PIN 1721.51 currently scheduled for letting 11/15/12, to address improvements on the Northway at Exit 4. We have no safety recommendations to offer for the project at this time on this section of highway.

Action Taken

Memo to R-1 Design dated 2/20/11.

Wolf Road @ Ulenski Case #10802348

Signals on Wolf Road

Central Ave.	1170'
Colonie Center South	1100'
Colonie Center North & DOT	1650'
Sand Creek	1240'
Computer Drive	1750'
Metro Park	1400'
Marcus Blvd	1350'
Exit 4 NB off	490'
Exit 4 NB on & I-87	

Marcus Blvd *Signal	780'
Ulenski Drive	530'
Exit 4 NB off *Signal	

- A 3-color signal @ Ulenski would adversely affect traffic flow on Wolf Road due to its close proximity to the adjacent signals.
- The existing traffic signals on Wolf Road create adequate gaps for vehicles exiting (and making the LT onto) Ulenski Drive.

→ A 3-color signal should not be considered for Ulenski Drive.

- A 'Do Not Block Side Road' sign already exists.

- no changes are recommended

KFF 12/15/08

Wolf Road @ Ulenski Case #1080248

I observed the operation of the intersection on 12/16/08 from 3:00 to 4:00 PM. I made the following observations:

- A 'Do Not Block Side Road' sign already exists on NB Wolf Road at the intersection.
- Northbound traffic favors the left lane. Some of this may be due to vehicles trying to avoid the side-friction caused by driveway traffic, but the main reason appears to be that vehicles get in the left lane in order to position themselves for the IA-SR intersection.
- The existing signals on Wolf Road created adequate gaps for vehicles exiting Ulenski Drive.
- The existing TWLTL provides adequate refuge for SB vehicles making the LT onto Ulenski.
- No instances were observed where a stopped vehicle on NB Wolf Road 'waved out' a LT'er on Ulenski.
- Occasionally, NB vehicles in the left lane queued through the Ulenski intersection, but generally they respected the intersection and stopped before it in order to avoid blocking it. The right lane never queued to Ulenski.

RFF 12/18/08

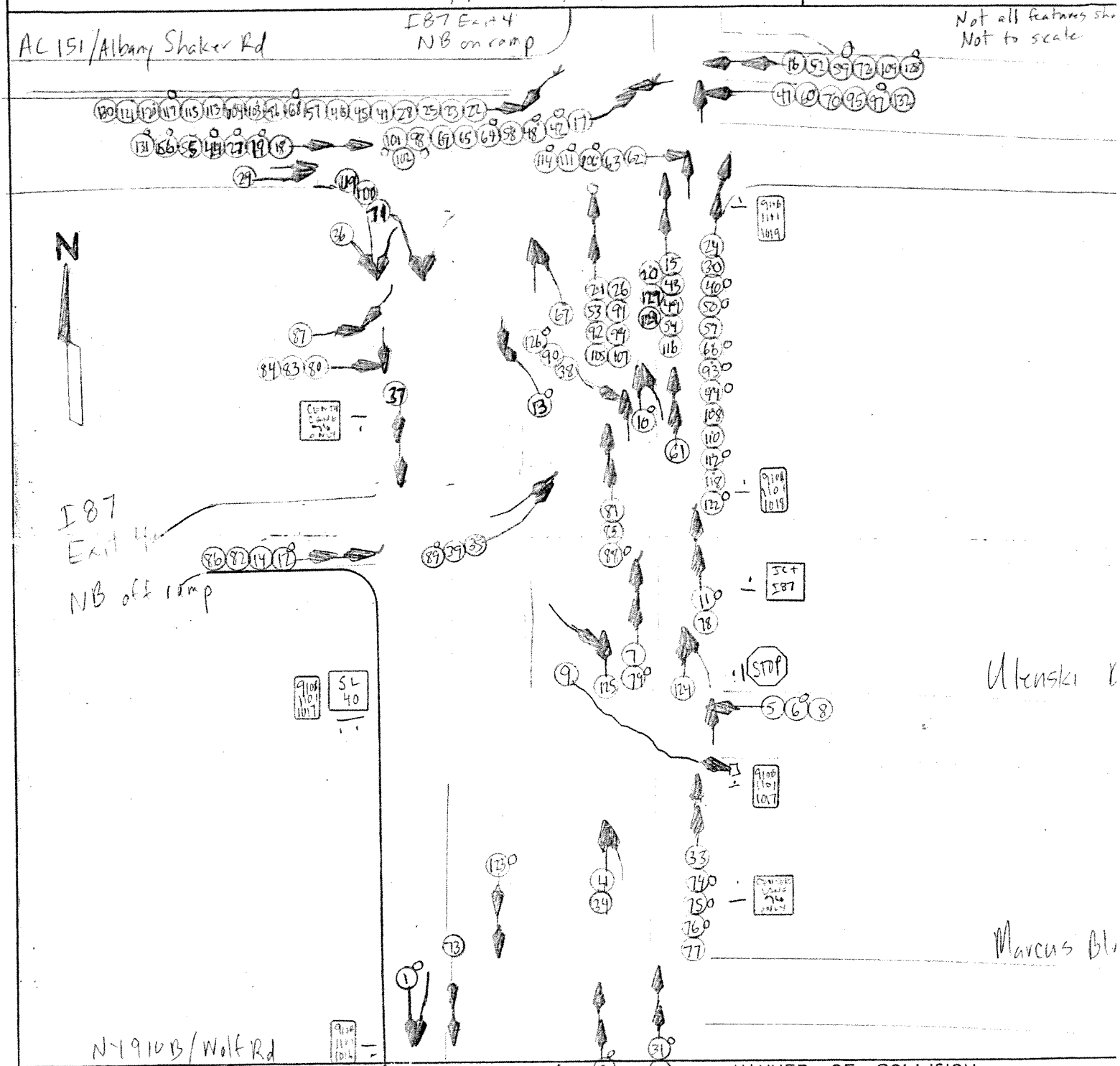
TE 56 (4/69)

DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING AND SAFETY DIVISION
COLLISION DIAGRAM 4

Sheet 1 of 10

Municipality Town of Colonie County Albany
Intersection NY 910B ; RM 910B - 1101 - 1016 TO 1019 X
Period 3 Years 3 Months From 1/1/07 To 3/31/10

File DMV/SIMS/ALIS
By MED Date 2/16/11



SYMBOLS

- Moving Vehicle
- M — Motorcycle
- Backing Vehicle
- Stopped Vehicle
- Parked Vehicle
- Pedestrain
- B — Bicycle
- Fixed Object
- O Personal Injury
- Fatal Injury

MANNER OF COLLISION

- Rear-end
- Side-swipe
- Out of control
- Skidding
- Overturned
- Head-on
- Left-turn
- Right-angle

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 4

COUNTY Albany OR IDENT. 1104777

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.
FILE DMV/ACIS/SIMS
BY MED
DATE 1/10/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
1	2/26/07	5:28P	2	PI-1	2	1	2	2	20	1016	OVERTAKE-SB, V-1 CHANGED LANES
2	5/16/07	5:02P	2	PI-1	1	1	2	2	4	1016	REAR END-NB, V-2 STOPPED IN TRAFFIC
3	8/15/07	3:06P	2	PI-1	1	1	1	1	9,26	1016	REAR END-NB, V-1 SLOWED TO MAKE RIGHT TURN
4	4/17/07	4:47P	2	PDO	1	1	1	2	20	1017	OVERTAKE-NB, V-1 CHANGED LANES
5	9/8/07	8:04P	2	PDO	4	1	2	3	7	1017	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
6	9/23/07	6:39P	2	PI-2	3	1	1	1	7	1017	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
7	11/26/07	4:18P	2	PDO	4	1	2	3	4	1017	REAR END-NB, V-2 STOPPED IN TRAFFIC
8	11/27/07	9:05P	2	PDO	1	1	2	2	7	1017	RIGHT ANGLE, V-1 WAVED INTO TRAFFIC WB, STRUCK BY NB V-2
9	12/2/07	3:01A	1	PDO	4	1	1	2	2,19	1017	SB V-1 ATTEMPTED LEFT TURN, STRUCK WALL
10	8/18/07	9:52P	2	PI-1	4	1	1	1	13,18	1018	OVERTAKE-NB, V-1 CHANGED LANES
11	9/22/07	7:06P	2	PI-2	4	1	2	2	4,66	1018	REAR END-NB, V-2 STOPPED IN TRAFFIC AT SIGNAL
12	12/13/07	11:38A	2	PI-1	1	2	4	4	4,66	1018	REAR END-EB, V-2 STOPPED IN TRAFFIC AT SIGNAL
13	12/18/07	5:37P	2	PI-1	4	1	4	2	7	1018	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
14	12/28/07	4:15P	2	PDO	3	5	1	1	9	1018	REAR END-EB, V-1 STOPPED IN TRAFFIC AT SIGNAL
15	1/12/07	11:47A	2	PDO	1	1	1	2	4	1019	REAR END-NB, BOTH VEHICLES STOPPED, V-1 JUMPED ON GREEN

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 4

SHEET 3 OF 10

COUNTY Albany ~~P.I.N.~~ OR IDENT. 110477

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.
FILE DMV/ALIS/SIMS
BY MED
DATE 2/4/11

TIME PERIOD: NUMBER OF MONTHS 39 FROM 1/1/07 TO 3/31/10

ENVIRONMENTAL: Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
17	1/21/07	11:28P	2	PDO	4	1	1	1	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
18	1/29/07	2:15P	2	PDO	1	1	1	1	4	1019	REAR END-EB, V-2 STOPPED IN TRAFFIC AT SIGNAL
19	3/19/07	9:12A	3	PI-1	1	1	4	2	66	1019	REAR END-EB, V-2 & V-3 STOPPED AT SIGNAL, V-1 SLID ON ICE
20	3/30/07	8:24P	3	PDO	4	1	1	1	4	1019	REAR END-NB, V-2 & V-3 SLOWING FOR SIGNAL, V-1 STRUCK V-2
21	6/6/07	9:06P	2	PI-1	4	1	1	2	4	1019	REAR END-NB, V-1 BRAKED ABRUPTLY IN TRAFFIC AT SIGNAL
22	6/18/07	7:24A	2	PDO	1	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
23	7/25/07	11:18A	2	PI-2	1	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
24	8/8/07	8:00A	2	PDO	1	1	2	2	9	1019	REAR END-NB, BOTH VEHS STOPPED, V-1 STARTED ROR STOPPED
25	8/20/07	1:10P	2	PDO	1	1	1	2	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
26	10/26/07	9:17A	2	PI-1	1	1	1	6	4	1019	REAR END-NB, V-2 STOPPED IN TRAFFIC AT SIGNAL
27	11/19/07	9:14P	2	PI-1	4	1	1	1	4	1019	REAR END-EB, V-2 STOPPED IN TRAFFIC AT SIGNAL
28	11/20/07	7:30P	2	PDO	4	1	2	2	4,7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
29	11/21/07	12:27P	2	PDO	1	1	1	2	20	1019	OVERTAKE-EB, V-1 CHANGED LANES
30	12/26/07	2:05P	2	PDO	1	1	1	2	4	1019	REAR END-NB, V-1 STOPPED, STARTED ROR STOPPED AGAIN
31	4/13/08	9:08P	2	PI-1	3	1	1	1	2,19	1016	REAR END-NB, V-2 STOPPED IN TRAFFIC AT SIGNAL

TE 213 (9/79)

DIAGRAM NO. 4

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 4 OF 10

COUNTY Albany — ~~P.I.N.~~ OR IDENT. 1 1 0 4 7 7

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B-1101-1016 TO 1019

CASE NO.
FILE DMV/ACIS/Sims
BY MED
DATE 2/4/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
33	6/13/08	5:56P	2	PDO	1	1	1	1	4	1017	REAR END-NB V-2 STOPPED IN TRAFFIC
34	12/3/08	7:30P	2	PDO	5	1	1	1		1017	OVERTAKE-NB, V-2 CHANGED LANES
35	1/22/08	4:30P	2	PDO	3	2	1	1	18	1018	OVERTAKE-EB, BOTH VEHS MAKING LEFT TURNS
36	8/30/08	1:18A	2	PDO	4	1	2	2	20	1018	OVERTAKE-SB, WB V-1 MADE RIGHT, EB V-2 MADE LEFT
37	9/17/08	A	2	PDO	1	1	1	1		1018	REAR END-SB, V-1 STOPPED AT RED TRAFFIC SIGNAL
38	10/3/08	9:37P	2	PDO	4	1	1	2	7,2,2	1018	SB V-1 ATTEMPTED LEFT TURN, STRUCK BY NB V-2
39	12/4/08	12:26P	2	PDO	1	5	2	3	19,13	1018	OVERTAKE-EB, V-1 LOST CONTROL EXITING
40	1/4/08	6:03P	2	PI-2	4	1	1	1	4	1019	REAR END-NB, V-1 STOPPED, STARTED ROP, STOPPED AGAIN
41	1/6/08	5:30P	2	PDO	4	1	2	2	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
42	1/8/08	3:07P	2	PI-3	1	1	1	2	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
43	1/15/08	2:00P	2	PDO	1	1	2	2		1019	REAR END-NB, V-1 SLOWING IN TRAFFIC AT SIGNAL
44	2/6/08	2:07P	2	PI-1	1	1	2	3	9	1019	REAR END-EB, BOTH VEHICLES STARTING IN TRAFFIC
45	2/19/08	9:21P	2	PDO	4	1	1	1	4	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
46	3/28/08	9:56A	2	PDO	1	1	4	4	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
47	4/17/08	5:56P	2	PDO	1	1	1	1	27,27	1019	RIGHT ANGLE V-1 WB IN INTERSECTION, NB V-2 JUMPED ON GREEN

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 4

COUNTY Albany — ~~P.I.N.~~ OR IDENT. 1 1 0 4 7 7

☐ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910 B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.
FILE DMV / ALIS / SIMS
BY MED
DATE 2/8/11

TIME PERIOD
NUMBER OF MONTHS 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTOR	RW	⑪ DESCRIPTION
49	4/25/08	11:42A	2	PDO	1	5	1	1		1019	REAR END-NB, BOTH VEHICLES STARTING IN TRAFFIC
50	5/1/08	8:36A	2	PI-1	1	1	1	1	4	1019	REAR END-NB, V-2 STOPPED, STARTED, STOPPED AGAIN
51	5/8/08	6:10P	2	PDO	1	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
52	6/1/08	12:01P	2	PI-1	1					1019	REAR END-WB, V-2 STOPPED AT RED TRAFFIC SIGNAL
53	6/12/08	5:00P	2	PI-1	1	1	1	1		1019	REAR END-NB, V-1 STOPPED IN TRAFFIC AT SIGNAL
54	6/14/08	P	2	PDO	1	1	2	3		1019	REAR END: NB, V-1 STOPPED IN TRAFFIC AT SIGNAL
55	7/7/08	12:15P	2	PDO	1	1	1	1		1019	REAR END-EB, BOTH VEHS STOPPED, OP-2 FOOT SLIPPED FROM BRAKE
56	7/9/08	6:29P	2	PI-1	1	1	1	1	4	1019	REAR END-EB, V-2 SLOWING TO TURN
57	7/28/08	3:00P	2	PDO	1					1019	REAR END-NB, V-2 STOPPED, STARTED, STOPPED AGAIN
58	7/29/08	10:23A	2	PDO	1	1	1	1		1019	EB V-2 ATTEMPTED LEFT TURN, STRUCK BY WB V-1
59	7/29/08	1:27P	2	PI-1	1	1	1	1	4	1019	REAR END-WB, V-2 STOPPED IN TRAFFIC AT SIGNAL
60	8/12/08	6:55P	2	PDO	3	1	1	1		1019	RIGHT ANGLE, NB V-1 STRUCK WB V-2, BOTH CLAIM GREEN
61	9/2/08	1:37P	2	PDO	1	1	1	1	26	1019	REAR END-NB, V-1 STOPPED BEHIND UNINVOLVED VEH
62	9/3/08	11:56P	2	PDO	4	1	1	2	17,7	1019	RIGHT ANGLE, EB V-1 PASSED RED SIGNAL, STRUCK NB V-2
63	9/10/08	8:52A	2	PDO	1	1	1	1	60,69	1019	RIGHT ANGLE, EB V-1 PASSED RED SIGNAL, STRUCK NB V-2

TE 213 (9/79)

DIAGRAM NO. 4

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

COUNTY Albany — ~~P.I.N.~~ OR IDENT. 110477

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.
FILE DMV/ALIS/SIMS
BY MED
DATE 2/8/11

TIME PERIOD
NUMBER OF MONTHS 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS (Use Codes from MV 104 Police Report — see back of this form for codes)	RM	⑪ DESCRIPTION
65	10/5/08	8:10P	2	PDO	4	1	1	1		1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
66	10/8/08	5:15P	2	PI-1	1	1	1	2	4	1019	REAR END-NB, V-2 SLOWING AT SIGNAL, OP-1 LOOKING LEFT FOR RR
67	10/15/08	A	2	PDO	4	4	1	1		1019	OVERTAKE-NB, V-2 ATTEMPTED LEFT FROM RIGHT LANE
68	10/16/08	6:44P	3	PI-1	4	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
69	11/21/08	6:19P	2	PDO	4	1	1	1	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
70	11/25/08	1:22P	2	PDO	1	1	2	3	17	1019	RIGHT ANGLE, NB V-1 PASSED RED SIGNAL, STRUCK WB V-2
71	12/10/08	8:18A	2	PDO	1	1	2	3	7	1019	OVERTAKE-SB, EB V-2 MADE RIGHT TURN, WB V-1 MADE LEFT
72	12/10/08	12:39P	2	PDO	1	1	2	3	4	1019	REAR END-WB, V-1 STOPPED IN TRAFFIC AT SIGNAL
73	4/24/09	7:29A	2	PDO	1	1	1	1	9,26	1016	REAR END-SB, V-2 BRAKED ABRUPTLY BEHIND UNINVOLVED VEH
74	1/12/09	4:15P	2	PI-1	1	1	1	1	4	1017	REAR END-NB, V-2 STOPPED IN TRAFFIC
75	1/16/09	5:17P	2	PI-2	4	1	1	1	4	1017	REAR END-NB, V-2 STOPPED IN TRAFFIC
76	12/3/09	5:26P	3	PI-2	4	1	1	2	4	1017	REAR END-NB, V-2 & V-3 STOPPED IN TRAFFIC
77	12/15/09	4:39P	2	PDO	4	1	1	1	4	1017	REAR END-NB, V-2 STOPPED IN TRAFFIC
78	7/27/09	6:56A	2	PDO	1	1	1	2	4	1018	REAR END-NB, V-2 STOPPED IN TRAFFIC AT SIGNAL
79	10/16/09	2:04P	2	PI-2	1	1	1	1	9	1018	REAR END-NB, V-2 STOPPED IN TRAFFIC

TE 213 (9/79) 4

DIAGRAM NO. ____

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 7 OF 10

COUNTY Albany — ~~P.I.N.~~ OR IDENT. 1 1 0 4 7 7

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101-1016 TO 1019

CASE NO.
FILE DMV / ALIS / SIMS
BY MED
DATE 2/9/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM: 1/1/07
TO: 3/31/10

ENVIRONMENTAL (Use codes from MV 104 (shown at right) for these categories)

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	SRI	⑪ DESCRIPTION
81	1/19/09	1:22P	2	PDO	1	1	2	2	9	1018	REAR END-NB, V-1 SLOWING IN TRAFFIC
82	2/15/09	3:34P	2	PDO	1	2	1	1	7	1018	REAR END-EB, V-2 STOPPED IN TRAFFIC AT SIGNAL
83	2/24/09	1:47P	2	PDO	1	1	1	1	7,4	1018	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
84	4/10/09	6:37P	2	PDO	1	1	1	1		1018	RIGHT ANGLE, V-2 ENTERED TRAFFIC EB, STRUCK BY SB V-1
85	5/15/09	A	3	PDO						1018	REAR END-NB, V-1 & V-3 STOPPED IN TRAFFIC, V-2 STRUCK V-1
86	6/6/09	9:12P	2	PDO	3	2	1	1	9,2	1018	REAR END-EB, V-1 STOPPED AT RED TRAFFIC SIGNAL
87	6/11/09	2:55P	2	PDO	1	1	1	2	7	1018	RIGHT TURN, SB V-1 MAKING RIGHT, STRUCK V-2 STOPPED EB
88	11/19/09	11:54A	2	PI-1	1	1	1	1	9	1018	REAR END-NB, V-2 STOPPED IN TRAFFIC
89	12/22/09	5:05P	2	PI-1	4	1	1	1	7,7	1018	OVERTAKE-EB, BOTH VEHICLES MAKING LEFT TURNS
90	12/30/09	3:37P	2	PDO	1	1	1	2	7,18	1018	SB V-1 ATTEMPTED LEFT TURN, STRUCK BY NB V-2
91	1/24/09	4:31P	2	PI-1	1	1	1	1	4	1019	REAR END-NB, V-2 STOPPED FOR RED TRAFFIC SIGNAL
92	2/22/09	9:00P	2	PI-1	4	1	2	1	4	1019	REAR END-NB, BOTH VEHS STOPPED, OP-1 FOOT SLIPPED FROM BRAKE
93	3/13/09	5:00P	2	PI-2	1	1	1	1	4	1019	REAR END-NB, V-2 STARTED RUR, STOPPED FOR EB TRAFFIC
94	3/21/09	4:45P	2	PI-2	1	1	1	1	4	1019	REAR END-NB, V-2 STARTED RUR, STOPPED, OP-1 LOOKING LEFT
95	3/30/09	2:59P	2	PDO	1	1	1	2	17	1019	RIGHT ANGLE, NB V-1 PASSED RED SIGNAL, STRUCK EB V-2

TE 213 (9/79)

DIAGRAM NO. 4

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 8 OF 10

COUNTY Albany ~~P.I.N.~~ OR IDENT. 1 1 0 4 7 7

☒ TOWN ☐ CITY ☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.

FILE DMV/ALIS/SIMS

BY MED

DATE 2/9/11

TIME PERIOD NUMBER OF MONTHS 39 FROM 1/1/07 TO 3/31/10

ENVIRONMENTAL Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	KM	⑪ DESCRIPTION
97	4/22/09	6:54P	2	PI-2	1	1	1	2	17,7	1019	RIGHT ANGLE, WB V-1 PASSED RED SIGNAL, STRUCK BY NB V-2
98	4/29/09	9:05P	2	PI-2	4	1	1	1	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
99	5/3/09	9:35A	2	PI-1	1					1019	REAR END-NB, V-1 STOPPED AT RED TRAFFIC SIGNAL
100	6/6/09	4:55P	2	PDO	1				7,18	1019	OVERTAKE-SB, WB V-1 MADE LEFT, EB V-2 MADE RIGHT
101	6/10/09	8:09P	2	PI-1	1	1	1	1	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
102	6/15/09	9:51A	2	PDO	1	1	1	2	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
103	6/20/09	12:57P	2	PDO	1	1	1	2	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
104	6/24/09	9:08A	2	PDO	1	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN STRUCK BY EB V-2
105	6/27/09	11:35A	2	PI-1	1	1	1	2	4	1019	REAR END-NB, V-1 STOPPED IN TRAFFIC AT SIGNAL
106	6/28/09	3:28P	2	PI-4	1	1	1	1	17	1019	RIGHT ANGLE, NB V-1 PASSED RED SIGNAL, STRUCK BY EB V-2
107	7/11/09	1:51P	2	PI-1	1	1	1	2	4	1019	REAR END-NB, BOTH VEHICLES STOPPED, V-1 JUMPED ON GREEN
108	7/16/09	1:05P	2	PDO	1	1	1	1		1019	REAR END-NB, V-2 STOPPED, STARTED ROLL, STOPPED AGAIN
109	9/9/09	2:58P	2	PDO	1	1	1	1	9	1019	REAR END-NB, V-1 SLOWING TO MAKE RIGHT TURN
110	9/12/09	12:46P	2	PDO	1	1	1	2	4	1019	REAR END-NB, V-1 STOPPED AT RED SIGNAL, OP-2 LOOKING LEFT
111	9/16/09	2:05P	2	PI-1	1	1	1	2	7,4	1019	RIGHT ANGLE, NB EMT V-1 W/ LIGHTS & SIREN, STRUCK BY EB V-2

TE 213 (9/79)

DIAGRAM NO. 4

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 9 OF 10

COUNTY Albany — ~~P.I.N.~~ OR IDENT. 110477

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.
FILE DMV/ALIS/SIMS
BY MED
DATE 2/10/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	PM	⑪ DESCRIPTION
113	10/7/09	4:23P	2	PDO	1	1	1	2	7	1019	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
114	10/15/09	12:44P	2	PI-2	1	1	1	2	17,7	1019	RIGHT ANGLE; EB V-1 PASSED RED SIGNAL, STRUCK NB V-2
115	10/26/09	2:01P	2	PDO	1	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
116	11/2/09	7:01P	2	PDO	5	1	1	1	22,9	1019	REAR END-NB, V-2 STOPPED IN TRAFFIC AT SIGNAL
117	11/28/09	6:00P	2	PI-1	4	1	1	2	7,4	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
118	12/6/09	P	2	PDO	1	1	1	2		1019	REAR END-NB, V-1 STOPPED, STARTED ROR, STOPPED AGAIN
119	12/16/09	7:59P	2	PDO	4	1	1	2	7	1019	OVERTAKE-SB, WB V-1 MAKING LEFT, EB V-2 MAKING RIGHT
120	12/17/09	7:01P	2	PDO	4	1	1	1	7,4	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
121	12/22/09	1:13P	2	PDO	1	1	1	1	7	1019	WB V-1 ATTEMPTED LEFT TURN, STRUCK BY EB V-2
122	12/31/09	3:28P	2	PI-1	1	1	2	2	4	1019	REAR END NB, V-2 STARTED ROR, STOPPED, OP V-1 LOOKING LEFT
123	1/9/10	3:56P	2	PI-2	1	1	1	1	9	1016	REAR END-SB, V-2 STOPPED IN TRAFFIC AT SIGNAL
124	1/13/10	8:44A	2	PDO	1	1	1	1	18,4	1017	OVERTAKE-NB, V-1 CHANGED LANES
125	3/18/10	3:56P	2	PDO	1	1	1	1	18	1017	SB V-1 ATTEMPTED LEFT TURN, STRUCK BY NB V-2
126	1/14/10	7:43A	2	PI-1	1	1	1	2	7,17	1018	SB V-1 ATTEMPTED LEFT TURN, STRUCK BY NB V-2
127	1/7/10	4:17P	3	PDO	3	1	1	2	4	1019	REAR END-NB, ALL VEHICLES STOPPED, OP-3 FOOT SLIPPED FROM BRAKE
128	1/15/10	5:18P	2	PI-1	1	1	2	2	4	1019	REAR END-NB, V-2 STOPPED IN SLIGHTLY FROM

TE 213 (9/79)

DIAGRAM NO. 4

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 10 OF 10

COUNTY Albany ~~P.I.N.~~ OR IDENT. 110477

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1016 TO 1019

CASE NO.
FILE DMV/ALIS/SIMS
BY MED
DATE 2/10/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL
Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	STN	⑪ DESCRIPTION
									Use Codes from MV 104 Police Report — see back of this form for codes		
129	2/18/10	4:55P	3	PDO	1	1	1	1	49,49	1019	REAR END-NB, V-1 STOPPED IN TRAFFIC AT SIGNAL
130	2/26/10	6:56P	2	PDO	4	5	2	4	7	1019	EB V-1 ATTEMPTED LEFT TURN, STRUCK BY WB V-2
131	3/6/10	11:39A	2	PI-1	1	1	1	1	4	1019	REAR END-EB, V-2 STOPPED IN TRAFFIC AT SIGNAL
132	3/21/10	5:06A	2	PDO	4	1	1	1	2,17	1019	RIGHT ANGLE, NB V-1 PASSED RED SIGNAL, STRUCK WB V-2

ACCIDENT SUMMARY SHEET

Case # _____

Municipality: Town of Colonie

County: Albany

Location: 87I Ex. 4 Route 155

PIN ~~HSI #~~: 1721.51

Time Period: 1/1/07 - 2/28/10

No. of Months: 38

Accident Type	No. of Accidents
Rear End	39
Right Angle	
Overtaking	3
Left Turn	
Sideswipe/ Head-on	
Right Turn	
Parked Vehicle	1
Debris	
Pedestrian	
Bicycle	
Animal	
Backing	
Fixed Object	7
w/ Utility Poles	
w/ Guide Rail / Barrier	5
w/ Sign Post	1
w/ Trees	
W/ Ditch / Embankment	1
w/	
TOTAL	50

Pavement Condition	No. of Accidents
Dry	33
Wet	13
Snow / Ice / Slush	3
Unknown	1
TOTAL	50

Weather	No. of Accidents
Clear	21
Cloudy	19
Rain	5
Snow	3
Sleet	
Fog	1
Unknown	1
TOTAL	50

Light Conditions	No. of Accidents
Day	40
Night	9
Unknown	1
TOTAL	50

Accident Severity	No. of Accidents
Property Damage	33
Injury	17
Fatal	
TOTAL	50

ACCSUMM.wp

TE 56 (11/07)c

NYS DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & MOBILITY / OFFICE OF MODAL SAFETY & SECURITY
COLLISION DIAGRAM # 1

1 OF 2

Municipality TOWN OF COLONIE County ALBANY

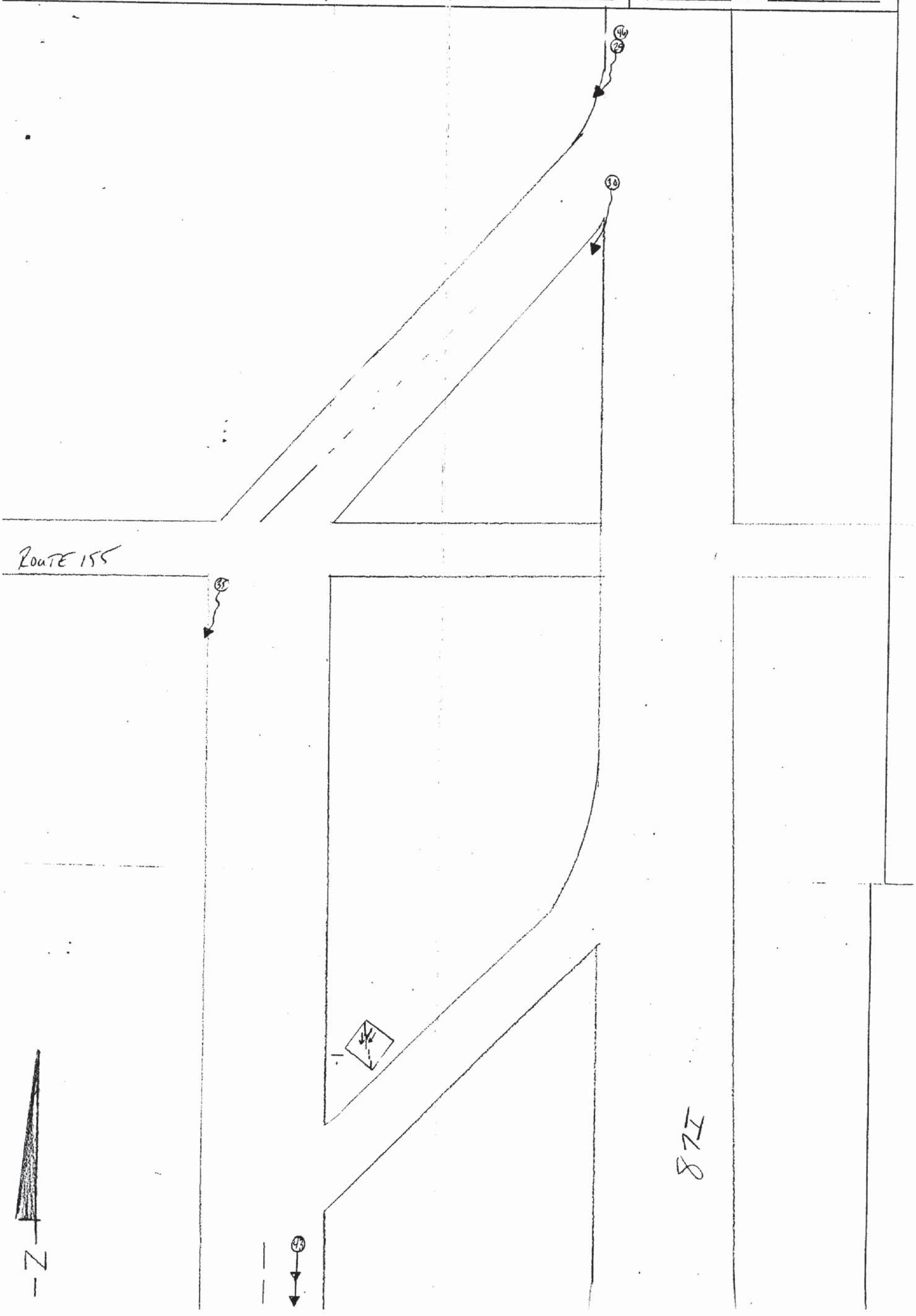
Intersection 87I @ EXIT 4 RAMPS

Period 3 Years 2 Months From 1/1/07 To 2/28/10

HSI # _____ Case # _____

File _____

By JJC Date 2/23/11



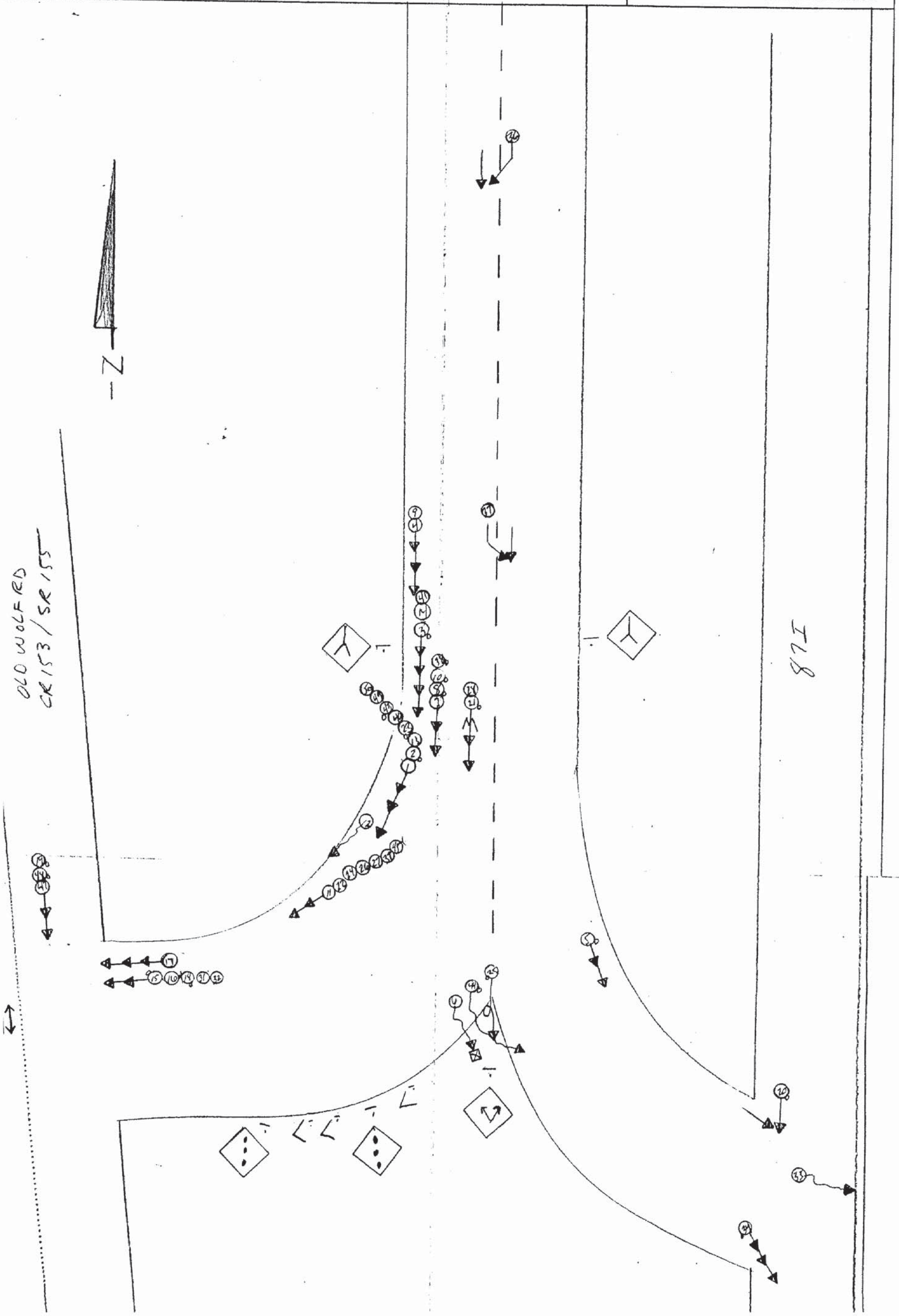
TE 56 (11/07)c

2 of 2

NYS DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC SAFETY & MOBILITY / OFFICE OF MODAL SAFETY & SECURITY
COLLISION DIAGRAM # 2

Municipality TOWN OF COLONIE County ALBANY
Intersection 87I @ EXIT 4 RAMPS
Period 3 Years 2 Months From 1/1/07 To 2/28/10

HSI # _____ Case # _____
File _____
By JJC Date 2/23/11



TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 1 & 2

COUNTY ALBANY P.I.N. OR IDENT.

☑ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME: 87I EXIT 4 RAMPS

AT INTERSECTION WITH/OR BETWEEN: ROUTE 155 / OLD WOLF RD.

CASE NO.
FILE
BY JJC
DATE 2/23/11

TIME PERIOD
NUMBER OF MONTHS: 38
FROM 1/1/07
TO 2/28/10

ENVIRONMENTAL
Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
1	2/8/07	0908	3	PDO	1	1	1	1	9,19	2026	SB U, R/E SB V2 INTO SB V3
2	3/22/07	1825	3	PI	1	1	2	3	19, 9	2026	SB U, R/E SB V2 INTO SB V3
3	4/11/07	0755	4	PI	1	1	1	1	9	2026	SB U, R/E SB V2 INTO SB V3 INTO V4
4	9/18/07	0837	3	PDO	1	1	1	1	9	2026	SB U, R/E SB V2 INTO SB V3
5	4/27/07	0900	2	PI	1	1	2	2	9, 19	2030	SB V, R/E SB V2
6	9/28/07	1750	1	PDO	1	4	2	3	26, 66	2030	SB V, SWERVES TO MISS UNINVOLVED VEH., GOES OFF ROAD STRIKING SIGN & FENCE
7	10/4/07	0759	2	PDO	1	1	1	2	9	2030	SB U, R/E SB V2
8	10/16/07	0827	2	PI	1	1	1	1	9	2030	SB U, R/E SB V2
9	10/26/07	1900	3	PDO	1	1	1	1	9	2030	SB U, R/E SB V2 INTO SB V3
10	11/21/07	0741	2	PI	1	1	2	6	9	2030	SB U, R/E SB V2
11	2/27/07	0851	2	PDO	1	1	2	4	9	2035	SB U, R/E SB V2
12	3/17/07	1108	1	PDO	1	5	5	2	19, 66	2035	SB U, TOO FAST FOR CONDITIONS LOSES CONTROL STRIKES GUIDERAIL
13	3/21/07	0831	3	PDO	1	1	1	1	9	2035	SB U, R/E SB V2 INTO SB V3
14	5/10/07	0743	4	PDO	1	1	1	1	9	2031	SB U, R/E SB V2 INTO SB V3 INTO SB V4
15	2/3/07	1045	2	PI	1	4	2	1	9	3050	WB U, R/E WB V2
16	8/2/07	0902	2	PDO	1	1	1	2	9	3050	WB U, R/E WB V2

TE 213 (9/79) /

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 1 & 2

COUNTY ALBANY P.I.N. OR IDENT.

☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME: 87I EXIT 4 RAMPS

AT INTERSECTION WITH/OR BETWEEN: ROUTE 155 / OLD WOLF RD.

CASE NO.
FILE
BY JJC
DATE 2/23/11

TIME PERIOD
NUMBER OF MONTHS: 38
FROM: 11/1/07
TO: 2/28/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

(1) NO	(2) DATE	(3) TIME	(4) NO. OF VEH.	(5) SEVERITY	(6) LIGHT CONDITIONS	(7) ROADWAY CHARACTER	(8) ROADWAY SURFACE CONDITION	(9) WEATHER	(10) APPARENT CONTRIBUTING FACTORS		(11) DESCRIPTION
									Use Codes from MV 104 Police Report see back of this form for codes		
17	2/13/07	0817	3	PDO	1	1	1	2	9	3050	WB, U, R/E WB U2 INTO WB U3
18	5/14/07	?	2	PI						3050	WB U, R/E WB U2
19	11/7/07	8753	2	PI	1	1	1	1	4	3050	WB U, R/E WB U2
20	5/16/08	0401	2	PI	5	1	1	2	7, 20	2026	SB U, MERGING ONTO 87I STRIKES SB U2 WHICH IS ON 87I
21	8/5/08	0805	2	PI	1	1	1	1	9	2030	SB U, MOTORCYCLE R/E SB U2
22	1/2/08	1459	2	PDO	1	1	2	2	9, 66	2035	SB U, R/E SB U2
23	4/30/08	0754	3	PI	1	1	1	1	9, 19	2035	SB U, R/E SB U2
24	4/30/08	0755	2	PDO	1	1	1	1	9	2035	SB U, R/E SB U2
25	6/25/08	0236	1	PI	4	1	1	2	2, 19	2035	SB U, MOTORCYCLE TRAVELING @ HIGH RATE OF SPEED MISSES TURN GOES INTO MEDIAN OVERTURNS
26	9/10/08	0742	2	PDO	1	1	1	1	9	2035	SB U, R/E SB U2
27	9/26/08	1900	2	PDO	5	1	2	3	9	2035	SB U, R/E SB U2
28	12/23/08	1350	2	PDO	1	1	1	2	9, 19	2035	SB U, R/E SB U2
29	2/12/08	2138	1	PDO	4	1	4	4	19, 66	2039	SB U, LOSES CONTROL ON SNOW HITS GUIDERAIL
30	12/17/08	0357	1	PDO	5	1	4	4	19, 66	2039	SB U, LOSES CONTROL ON SNOW HITS GUIDERAIL
31	4/30/08	0800	2	PDO	1	1	1	1	9, 4	3050	SB U, R/E SB U2
32	8/11/08	1644	2	PDO	1	1	2	3	66	3050	WB U2 R/E WB U1

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 1 2

COUNTY ALBANY — P.I.N. OR IDENT.

☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME: 87I EXIT 4 RAMPS

AT INTERSECTION WITH/OR BETWEEN: ROUTE 155 / OLD WOLF RD.

CASE NO.
FILE
BY JJC
DATE 2/23/11

TIME PERIOD
NUMBER OF MONTHS: 38
FROM: 1/1/07
TO: 2/28/10

ENVIRONMENTAL
Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
33	7/3/09	1710	1	PDO	1	5	2	2	19	2026	SB U, ENTERING 87I LOSES CONTROL, CROSSES 87I STRIKING GUIDERAIL
34	6/21/09	1046	3	PI	1	5	1	1	9, 26	2030	SB U_1, U_2, U_3 ENTERING 87I SB U_3 R/E U_2 OVERTURNING IT WHICH R/E V_1
35	7/3/09	1417	1	PDO	1	2	1	2	4, 18	2030	SB U, READING MAP STRIKES GUIDE RAIL
36	7/26/09	0221	2	PDO	4	1	2	3	2, 28	2035	SB U, PURSUED BY POLICE (U_2) U, SWERVES RIGHT INTO U_2
37	7/26/09	0221	2	PDO	5	1	2	3	2, 28	2035	SEE ABOVE U, SWERVED LEFT INTO U_2
38	1/15/09	0757	2	PI	1	1	1	2	9	2035	SB U, R/E SB U_2
39	1/22/09	0750	2	PDO	1	1	1	2	9	2035	SB U, R/E SB U_2
40	1/22/09	0825	3	PDO	1	1	1	2	19, 9	2035	SB U, R/E SB U_2 INTO SB U_3
41	4/23/09	0847	4	PDO	1	1	1	2	9	2035	SB U, R/E SB U_2 INTO SB U_3 INTO SB U_4
42	5/15/09	0748	3	PDO	1	1	1	1	20	2035	SB U, R/E SB U_2 INTO SB U_3
43	9/17/09	0809	2	PDO	1	1	1	1	9	2035	SB U, R/E SB U_2
44	11/29/09	1440	1	PI	5	4	1	1	20, 17	2035	SB U, UNSAFELY CHANGES LANES, LOSES CONTROL STRIKES CONSTRUCTION EQUIP
45	12/15/09	1722	2	PDO	5	1	1	2	9	2035	SB U, R/E SB U_2
46	1/13/09	0505	1	PDO	5	1	1	2	20	2039	SB U, ATTEMPTS LANE CHANGE LOSES CONTROL STRIKES GUIDE RAIL
47	5/31/09	1650	2	PDO	1	1	1	1	17, 9	2050	SB U1 R/E SB U2
48	8/29/09	1925	2	PI	3	1	2	2	7	2050	SB U1, R/E SB U_2

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 12

COUNTY ALBANY — P.I.N. OR IDENT.

☒ TOWN
☐ CITY
☐ VILLAGE OF COLONIE

ROUTE NO. OR STREET NAME: 87I EXIT 4 RAMPS

AT INTERSECTION WITH/OR BETWEEN: ROUTE 155 / OLD WOLF RD

CASE NO.
FILE
BY JJC
DATE 2/23/11

TIME PERIOD
NUMBER OF MONTHS: 38
FROM: 1/1/07
TO: 2/28/10

ENVIRONMENTAL
Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
49	2/5/10	1017	2	PDO	1	1	1	1	19	2035	SB V, R/E SB V2
50	3/17/10	0753	2	PDO	1	1	1	1	9	2035	SB V, RE SB V2

TE 156a (3/76)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION
HIGHWAY SAFETY
INVESTIGATION REPORT
(SEE INSTRUCTIONS ON REVERSE)

MAIN OFFICE USE:
DIVISION FILE
REVIEWED BY
SCHEDULED FOR B&A ☐

1. LOCATION

IDENT. NO.: 1 1 0 4 0 9

☒ TOWN ☐ CITY ☐ VILLAGE } OF Colonie

ROUTE NO. OR STREET NAME	STATE HIGHWAY NO.	FROM ~~OR AT~~ REFERENCE MARKER
NY 910B / Wolf Rd	69-1	910B 1101 101
At Intersection With (If Applicable)		TO REFERENCE MARKER
		910B 1101 101

2. REASON FOR INVESTIGATION
- ☒ (a) IDENTIFIED BY ACCIDENT SURVEILLANCE SYSTEM
- ☐ (b) POLICE HAZARD REPORT
- ☒ (c) RESPONSE TO COMPLAINT OR INQUIRY
- ☒ (d) REGIONALLY INITIATED PIN 1721.51
- ☐ (e) OTHER (Explain)

2009 PIL; Reduction Index = 21.22; Severity Rank = 3.01

3. RECOMMENDATION
- ☐ (a) CAPITAL IMPROVEMENT (Initiate Proj. Devel. Study)
- ☐ (b) TRAFFIC CONTROL IMPROVEMENT
- ☐ (c) MAINTENANCE IMPROVEMENT
- ☐ (d) OTHER
- ☒ (e) NONE

} complete sections 4 &

4. DISCUSSION (Use reverse if additional space is required – check box if reverse is used ☐)

(a) PROBLEMS IDENTIFIED

See attached Page 2 of 2

(b) PROPOSED SOLUTION

(c) ACTION TAKEN

5. ACCIDENT EXPERIENCE

Number of Months	PERIOD BEGINNING MONTH	PERIOD BEGINNING YEAR	NUMBER OF ACCIDENTS Fatal Accidents	Injury Accidents	Property Damage Accidents
10	01	07	0	5	10
24	11	07	0	10	18
05	11	09	0	5	6

6. BENEFIT/COST ANALYSIS (see instructions)

Check box if Benefit/Cost Calculations are attached ☐

PRINCIPAL INVESTIGATOR: Michael E Doody | TITLE: CE-II

APPROVED BY: [signature] | DATE: 3-3-11

Problems Identified

NY Route 910B, Wolf Road, was identified as a Priority Investigation Location (PIL) from RM 1010 to 1015 based on reportable accidents during the period 11/1/07 to 10/31/09. NY 910B, which travels north-south, is a four lane divided Urban Principal Arterial highway with free access. The travel way is 54 feet wide, which accommodates four lanes and a paved flush median that provides refuge for turning movements. This area is commercially developed with various businesses and driveways on both sides of the roadway. Pavement markings and signing are satisfactory. The posted speed limit is 40 MPH.

NY 910B is intersected by Computer Drive at RM 1010. The intersection is controlled by a three color traffic signal. NY 910B is intersected by the Wolf Road Shoppers Park drive from the east at RM 1011 in a stop controlled T-intersection. NY 910B is intersected by Cerone Commercial Drive from the west at RM 1012 in a stop controlled T-intersection. NY 910B is intersected by Metro Park Road from the east at RM 1013 in a T-intersection. The intersection is controlled by a three color traffic signal. NY 910B is intersected by Beltrone Drive from the east at RM 1014 in a stop controlled T-intersection.

The accident study period was 39 months, 1/1/07 to 3/31/10. Based on the 54 accidents that occurred during the study period the accident rate is 2.50 ACC/MVM. This rate is less than the expected accident rate of 3.59 ACC/MVM for similar highways statewide. There were 28 accidents during the 2 year HAL period. The majority of the accidents consisted of rear end, overtaking, and turning accidents due to traffic congestion, generally grouped at the driveways and intersections. There was one accident involving a pedestrian and no accidents involving bicyclists. Of the 53 accidents on this section of highway with pavement condition reported, 14 (26%) occurred on wet pavement and no accidents occurred on snow/ice/slush pavements. There were 7 accidents during the morning commute hours from 6 am to 9 am and 16 accidents occurred during the peak evening commute from 3 pm to 6 pm.

Proposed Solution

There is a project, PIN 1721.51 currently scheduled for letting 11/15/12, to address improvements on the Northway at Exit 4. We have no safety recommendations to offer for the project at this time as a result of this review of the accident history.

Action Taken

Memo to R-1 Design dated 2/16/11.

TE 156a (3/76)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION
HIGHWAY SAFETY
INVESTIGATION REPORT
(SEE INSTRUCTIONS ON REVERSE)

MAIN OFFICE USE:
DIVISION FILE _____
REVIEWED BY _____
SCHEDULED FOR B&A ☐

1. LOCATION

IDENT. NO.: 110495

☒ TOWN
☐ CITY
☐ VILLAGE
OF Colonie

ROUTE NO. OR STREET NAME	STATE HIGHWAY NO.	FROM OR AT REFERENCE MARKER
ACR 151 / Albany Shaker Rd		155 1101 304

At Intersection With (If Applicable)	ROUTE NO. OR STREET NAME	STATE HIGHWAY NO.	TO REFERENCE MARKER
	ACR 153 / Old Wolf Rd		

2. REASON FOR INVESTIGATION
- ☒ (a) IDENTIFIED BY ACCIDENT SURVEILLANCE SYSTEM
- ☐ (b) POLICE HAZARD REPORT
- ☒ (c) RESPONSE TO COMPLAINT OR INQUIRY PIN 1721.51
- ☒ (d) REGIONALLY INITIATED ARWP
- ☒ (e) OTHER (Explain) _____

2008 PIL; Red Index = 18.11; Sev Rank = 15.09

3. RECOMMENDATION
- ☐ (a) CAPITAL IMPROVEMENT (Initiate Proj. Devel. Study)
- ☐ (b) TRAFFIC CONTROL IMPROVEMENT
- ☒ (c) MAINTENANCE IMPROVEMENT
- ☐ (d) OTHER refresh Striping
- ☐ (e) NONE

complete sections 4 &

4. DISCUSSION (Use reverse if additional space is required — check box if reverse is used ☐)

(a) PROBLEMS IDENTIFIED

(b) PROPOSED SOLUTION

(c) ACTION TAKEN

5. ACCIDENT EXPERIENCE

Number of Months	PERIOD BEGINNING MONTH	PERIOD BEGINNING YEAR	NUMBER OF ACCIDENTS Fatal Accidents	Injury Accidents	Property Damage Accidents
12	01	07	0	7	6
12	01	08	0	0	4
12	01	09	0	1	3

6. BENEFIT/COST ANALYSIS (see instructions)

Check box if Benefit/Cost Calculations are attached ☐

PRINCIPAL INVESTIGATOR [signature] TITLE

APPROVED BY [signature] DATE 3-3-11

Problems Identified

NY Route 155 identified as a Priority Investigation at TH RM 3047 based on reportable accidents during the period 1/1/07 to 12/31/08.

This section of NY Touring Route 155 is the intersection of Albany County Route 151, Albany Shaker Road, traveling east-west with Albany County Route 153, Old Wolf Road, carrying Touring Route 155 north from the intersection, and the southbound on ramp to I87, the Northway, south from the intersection. The intersection is controlled with a 3 color traffic signal.

During the 36 month accident study period from 1/1/07 to 12/31/09 there were 21 total accidents. Of the 18 accidents with highway surface condition reported there were 5 (28%) wet pavement accidents and 2 (11%) snow/ice pavement accidents. There were 11 rear end accidents at the signal, including 7 SB. There is no apparent treatable pattern of accidents.

Proposed Solution

The dotted "skip marks' that separate the 2 SB left turn lanes were observed to be faded during the field review. These pavement markings were refreshed in October 2010.

Actions Taken

Letter to complainant, dated 12/22/10.

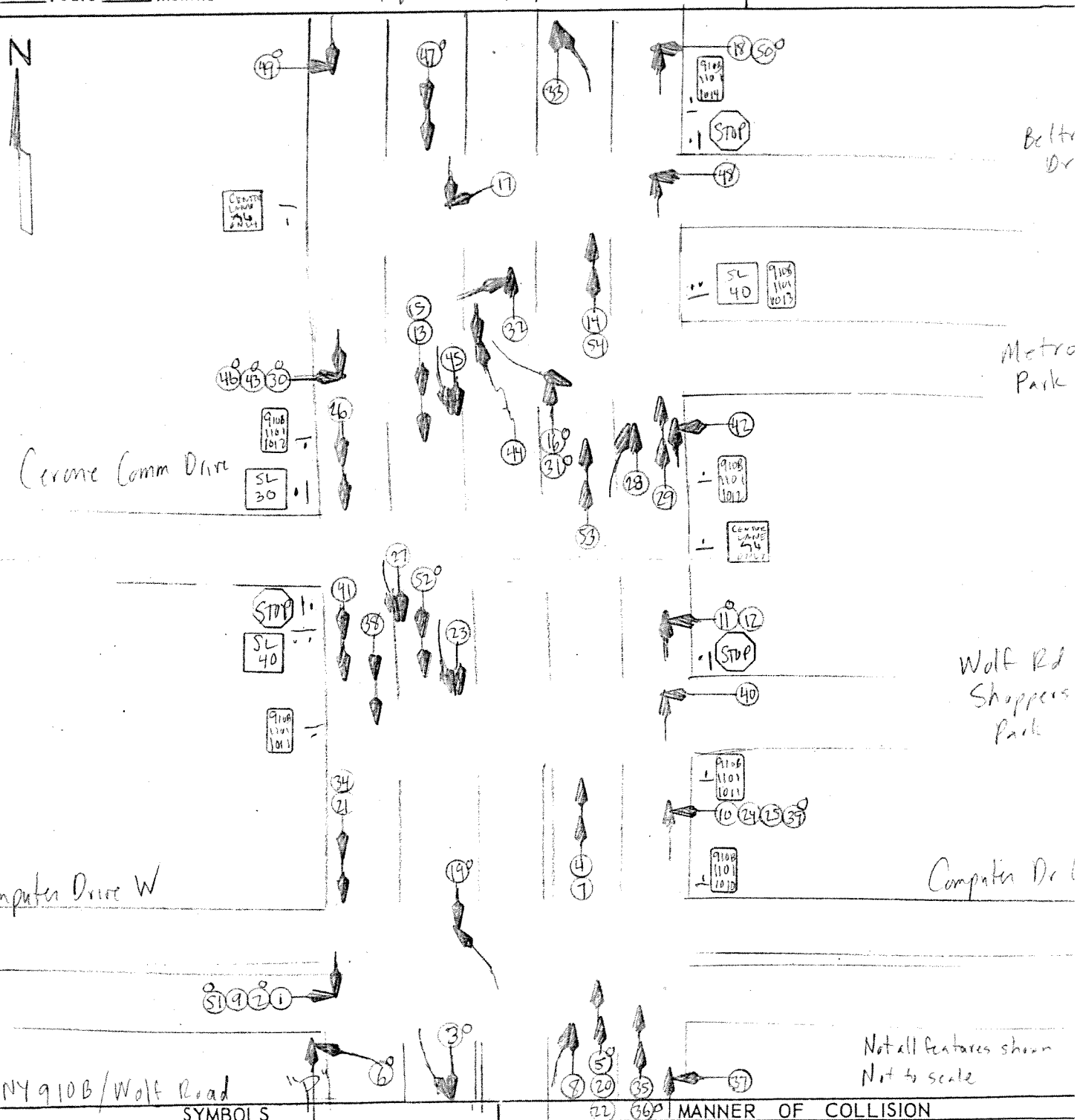
TE 56 (4/69)

DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING AND SAFETY DIVISION
COLLISION DIAGRAM #2

Sheet 1 of

Municipality Town of Colonie County Albany
Intersection NY 910B; RM 910B - 1101 - 1010 TO 1015
Period 3 Years 3 Months From 1/1/07 To 3/31/10

File DMV/ALIS/SIMS
By MED Date 2/14/11



SYMBOLS

- Moving Vehicle
- M — Motorcycle
- Backing Vehicle
- Stopped Vehicle
- Parked Vehicle
- Pedestrain
- B — Bicycle
- Fixed Object
- O Personal Injury
- Fatal Injury

MANNER OF COLLISION

- Rear-end
- Head-on
- Side-swipe
- Out of control
- Left-turn
- Skidding
- Overturned
- Right-angle

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 2 SHEET 2 OF 5

COUNTY Albany ~~P.I.N.~~ OR IDENT. 1 1 0 4 0 9

☒ TOWN ☐ CITY ☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910 G / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1010 TO 1015

CASE NO. FILE DMV/ALIS/Sims BY MED DATE 1/10/11

TIME PERIOD NUMBER OF MONTHS 39 FROM 1/1/07 TO 3/31/10

ENVIRONMENTAL Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS: 1. Daylight 2. Dawn 3. Dusk 4. Dark Road Lighted 5. Dark Road Unlighted

ROADWAY CHARACTER: 1. Straight and Level 2. Straight and Grade 3. Straight at Hillcrest 4. Curve and Level 5. Curve and Grade 6. Curve at Hillcrest

ROADWAY SURFACE CONDITION: 1. Dry 2. Wet 3. Muddy 4. Snow/Ice 5. Slush 10. Other

WEATHER: 1. Clear 2. Cloudy 3. Rain 4. Snow 5. Sleet/Hail/Freezing Rain 6. Fog/Smog/Smoke 10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	MM	⑪ DESCRIPTION
1	1/2/07	2:30P	2	PDO	1	1	1	1	7,17	1010	RIGHT ANGLE, EB V-2 MADE RIGHT ON RED, STRUCK SB V-1
2	2/8/07	12:31P	2	PI-1	1	1	1	1	4,17	1010	RIGHT ANGLE, SB V-1 RAN RED, STRUCK EB V-2
3	5/8/07	1:30P	2	PI-1	1	1	1	1	9,4	1010	OVERTAKE-SB, V-1 CHANGED LANES
4	5/19/07	5:43P	2	PDO	1	1	2	3	4	1010	REAR END-NB, OP V-2 FOOT SLIPPED FROM BRAKE
5	6/15/07	12:32P	2	PI-3	1	1	1	2	4	1010	REAR END-NB, V-2 STARTING TO GO ON GREEN
6	6/25/07	3:58P	1	PI-1	1	1	1	1	14	1010	NB V-1 MAKING LEFT INTO DRIVE, PED STEPPED BACK INTO PATH OF V-1
7	9/21/07	8:02A	2	PDO	1	1	1	1	4	1010	REAR END-NB, V-1 SLOWING TO MAKE TURN
8	10/26/07	10:03P	2	PDO	4	1	2	3	3,9	1010	OVERTAKE-NB, V-1 CHANGED LANES
9	11/18/07	11:26A	2	PDO	1	1	1	1	6,8	1010	RIGHT ANGLE, EB V-1 STRUCK BY SB V-2, SIGNAL NOT WORKING
10	1/12/07	3:27P	2	PDO	1	1	1	2	7	1011	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK NB V-2
11	5/29/07	9:40A	2	PI-1	1	1	1	1	7	1012	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
12	6/7/07	4:45P	2	PDO	1	1	1	1	7,13	1012	RIGHT ANGLE, V-1 WAVED INTO TRAFFIC WB, STRUCK BY NB V-2
13	1/12/07	8:41P	2	PDO	4	1	1	2	9	1013	REAR END-SB, V-2 SLOWING IN TRAFFIC
14	1/13/07	P	2	PDO	4	1	2	3		1013	REAR END-NB, V-2 SLOWING IN TRAFFIC
15	7/23/07	3:47P	2	PDO	1	1	2	3	9,66,26	1013	REAR END-SB, V-2 BRAKED ABRUPTLY BEHIND UNINVOLVED VEH

TE 213 (9/79)

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

DIAGRAM NO. 2

COUNTY Albany P.I.N. OR IDENT. 1 1 0 4 0 9

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910 3/Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B-1101-1010 TO 1015

CASE NO.
FILE DMV/ACIS/SIMS
BY MED
DATE 1/14/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM: 1/1/07
TO: 3/31/10

ENVIRONMENTAL (Use codes from MV 104 (shown at right) for these categories)

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
17	12/22/07	4:04P	2	PDO	4	1	1	2	7	1014	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY SB V-2
18	5/30/07	5:04P	2	PDO	1	1	1	1	7,13	1015	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
19	5/3/08	8:00A	3	PI-2	1	1	2	3	7	1010	NB V-1 ATTEMPTED LEFT TURN, STRUCK BY SB V-2
20	5/28/08	5:40P	3	PDO	1	1	1	1	4	1010	REAR END - NB, V-2 & V-3 STOPPED IN TRAFFIC AT SIGNAL
21	7/7/08	12:15P	2	PDO	1	1	2	2		1010	REAR END - SB, V-1 STOPPED AT RED TRAFFIC SIGNAL
22	10/6/08	8:33A	2	PDO	1	1	2	3	4	1010	REAR END - NB, V-2 STOPPED IN TRAFFIC AT SIGNAL
23	1/17/08	6:44P	2	PDO	4	1	1	1	4	1011	OVERTAKE - SB, V-1 CHANGED LANES
24	2/29/08	1:15P	2	PDO	1	1	1	2	17,7	1011	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
25	7/14/08	3:49P	2	PI-1	1	1	1	1	7	1011	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
26	1/15/08	3:19P	2	PDO	1	1	2	4	7	1012	REAR END - EB, V-2 SLOWING IN TRAFFIC
27	6/28/08	5:19P	3	PDO	1	1	1	1	20,9	1012	OVERTAKE - SB, V-1 CHANGED LANES
28	5/9/08	7:22P	2	PDO	1					1013	OVERTAKE, NB, V-1 CHANGED LANES
29	9/2/08	5:14P	2	PDO	1	1	1	1	4	1013	REAR END - NB, V-1 STOPPED AT RED TRAFFIC SIGNAL
30	11/13/08	8:59A	3	PI-1	1	1	2	2	7	1013	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB STRUCK BY SB V-2
31	11/14/08	9:18A	2	PI-1	1	1	2	2	7	1013	SB V-2 MAKING LEFT TURN, NB V-1 PASSED RED SIGNAL

TE 213 (9/79)

DIAGRAM NO. 2

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 4 OF 5

COUNTY Albany — ~~P.I.N.~~ OR IDENT. 1 1 0 4 0 9

☒ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1010 TO 1015

CASE NO.
FILE DMV/AUS/SIMS
BY MED
DATE 2/4/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM 1/1/07
TO 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	RM	⑪ DESCRIPTION
33	10/17/08	9:21A	2	PDO	1	1	1	1	18,20	1015	OVERTAKE-NB, V-1 CHANGED LANES
34	11/3/09	7:43A	2	PDO	1	1	1	1	4	1010	REAR END-SB, BOTH VEHICLES STARTING IN TRAFFIC AT SIGNAL
35	11/12/09	11:21A	2	PDO	1	1	1	1	9	1010	REAR END- NB, V-2 SLOWING IN TRAFFIC
36	11/12/09	11:28A	2	PI-1	1	1	1	2	9	1010	REAR END- NB, V-2 SLOWING IN TRAFFIC FOR #35 ABOVE
37	12/10/09	1:21P	2	PDO	1	1	1	2	7,26	1010	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
38	9/18/09	1:02P	3	PDO	1	1	1	2	9	1011	REAR END-SB, V-2 AND V-3 STOPPED IN TRAFFIC
39	9/18/09	1:04P	2	PI-1	1	1	1	1	7	1011	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
40	10/19/09	12:30P	2	PDO	1	1	1	1	7	1011	RIGHT ANGLE, WB V-2 MADE RIGHT IFO NB V-1
41	12/11/09	1:30P	2	PDO	1	1	1	1	26	1012	REAR END-SB, V-1 STOPPED IN TRAFFIC
42	1/19/09	2:45P	2	PDO	1	1	2	2	4,7	1013	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
43	7/1/09	7:12P	2	PI-2	1	1	2	3	7	1013	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
44	7/24/09	12:55P	2	PDO	1	1	1	2	2,27	1013	HEAD ON - V-2 STOPPED AT SIGNAL SB, NB V-1 VEERED OVER ℄
45	11/27/09	10:20P	2	PDO	4	1	1	2	7	1013	OVERTAKE-SB, V-1 ATTEMPTED LEFT TURN FROM RIGHT LANE
46	12/2/09	8:47A	2	PI-2	1	1	1	1	17,7	1013	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK SB V-2
47	2/27/09	5:15P	3	PI-1	1	1	2	3	4	1014	REAR END-SB, V-2 SLOWING AT SIGNAL, V-2 STRUCK NB V-3

TE 213 (9/79)

DIAGRAM NO. 2

DETAILS OF ACCIDENT HISTORY FOR LOCATION (AS SHOWN ON COLLISION DIAGRAM)

SHEET 5 OF 5

COUNTY Albany — P.I.N. OR IDENT. 1 1 0 4 0 9

☐ TOWN
☐ CITY
☐ VILLAGE OF Colonie

ROUTE NO. OR STREET NAME: NY 910B / Wolf Rd

AT INTERSECTION WITH/OR BETWEEN: RM 910B - 1101 - 1010 TO 1015

CASE NO.
FILE DMV/HLIS/SIMS
BY MED
DATE 2/9/11

TIME PERIOD
NUMBER OF MONTHS: 39
FROM: 1/1/07
TO: 3/31/10

ENVIRONMENTAL — Use codes from MV 104 (shown at right) for these categories

LIGHT CONDITIONS
1. Daylight
2. Dawn
3. Dusk
4. Dark Road Lighted
5. Dark Road Unlighted

ROADWAY CHARACTER
1. Straight and Level
2. Straight and Grade
3. Straight at Hillcrest
4. Curve and Level
5. Curve and Grade
6. Curve at Hillcrest

ROADWAY SURFACE CONDITION
1. Dry
2. Wet
3. Muddy
4. Snow/Ice
5. Slush
10. Other

WEATHER
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Sleet/Hail/Freezing Rain
6. Fog/Smog/Smoke
10. Other

Use Codes from MV 104 Police Report — see back of this form for codes

① NO	② DATE	③ TIME	④ NO. OF VEH.	⑤ SEVERITY	⑥ LIGHT CONDITIONS	⑦ ROADWAY CHARACTER	⑧ ROADWAY SURFACE CONDITION	⑨ WEATHER	⑩ APPARENT CONTRIBUTING FACTORS	SUM	⑪ DESCRIPTION
49	2/20/09	4:34P	2	PI-2	1	1	1	2	7,5	1015	RIGHT ANGLE, V-1 ENTERED TRAFFIC EB, STRUCK BY SB V-2
50	10/31/09	6:49A	2	PI-1	4	1	2	3	7	1015	RIGHT ANGLE, V-1 ENTERED TRAFFIC WB, STRUCK BY NB V-2
51	3/28/10	12:18P	2	PI-1	1	1	1	2	17,7	1010	RIGHT ANGLE, SB V-1 PASSED RED SIGNAL, STRUCK EB V-2
52	1/15/10	6:13P	2	PI-2	4	1	1	2	4	1011	REAR END-SB, V-1 STOPPED TO MAKE TURN
53	3/18/10	12:30P	2	PI-1	1	1	1	2	9	1013	REAR END-NB, V-2 BRAKED ABRUPTLY BEHIND UNINVOLVED VEH
54	3/26/10	5:16P	2	PDO	1	1	1	1	4,9	1014	REAR END-NB, V-2 SLOWING IN TRAFFIC

MEMORANDUM
DEPARTMENT OF TRANSPORTATION

TO: **A. Trichilo, R-1 Design, 3rd floor**

FROM: **M.J. Kennedy, R-1 Traffic Engineer, 4th floor**

SUBJECT: **PIN 1721.51: I87 Exits 3/4**
Updated Accident Data
Town of Colonie, Albany County

DATE: **May 11, 2010**

Attached please find the updated Verbal Description Reports for the subject project as you requested on 3/23/10. The accident data covers the 3 year period from 1/1/07 to 12/31/09.

The Northway, I87, is a six lane divided Urban Principal Arterial Interstate highway with full control of access. There were no High Accident Locations (HALs) on the section of highway from RM 2018 to 2042 based on accident data between 11/1/07 and 10/31/09. There were 262 total accidents on this segment of I87 during the study period. The accident rate was 0.90 ACC/MVM which is less than the expected accident rate of 1.10 ACC/MVM for similar highways statewide. There were no accidents involving pedestrians or bicyclists.

NY 910B, Wolf Road, is a four lane divided Urban Principal Arterial highway with free access. Wolf Road is a Priority Investigation Location (PIL) from RM 1010 to 1015 and from RM 1016 to 1019 based on accident data between 11/1/07 and 10/31/09. There were 166 total accidents on this segment of Wolf Road during the study period. The accident rate was 4.60 ACC/MVM which is greater than the expected accident rate of 3.59 ACC/MVM for similar highways statewide. There was one accident involving a pedestrian and no accidents involving bicyclists. These locations have been added to the program for Highway Safety Investigations. HSI reports will be forwarded when completed.

NY 155, Watervliet Shaker Road, is a two lane divided Urban Minor Arterial highway with free access. Watervliet Shaker Road is a Safety Deficient Location (SDL) from RM 3058 to 3061 based on accident data between 11/1/07 and 10/31/09. There were 35 total accidents on this segment of Watervliet Shaker Road during the study period. The accident rate was 7.99 ACC/MVM which is greater than the expected accident rate of 3.94 ACC/MVM for similar highways statewide. There was one accident involving a pedestrian and no accidents involving bicyclists. This location has been added to the program for a Highway Safety Investigation. A HSI report

will be forwarded when completed.

Accident data is attached for Albany County Route 151, Albany Shaker Road, from Wolf Road to Dalessandro Boulevard. There were 118 accidents on this segment of Albany Shaker Road during the study period. A signal study at the intersection of CR 151 with Old Wolf Road (CR 153) and the Exit 4 SB on ramp is underway. A HSI report will be forwarded when completed.

Accident data is attached for Albany County Route 153, Old Wolf Road, from Albany Shaker Road to the Exit 4 SB off ramp. There were 43 accidents on this segment of Old Wolf Road during the study period.

Accident data is attached for the I87 SB Exit 5/Exit 4 Merge Diverge Area service road. There were 19 accidents on the various ramp segments during the study period.

Please be advised that accident data at intersections and ramps will appear on both roadways in the summaries. We have no safety recommendations to make as a result of our initial review of this accident history. If you have any questions concerning the data provided, please contact Mike Doody of this office at 388-0372.

MJK:MED
Attachments

cc: J. Rutnik, Traffic 4th floor

ATTACHMENT G
PEDESTRIAN GENERATOR CHECKLIST

PIN: 1721.51
DESCRIPTION: Exit 3/4 Access Improvements
MUNICIPALITY/COUNTY: Town of Colonie / Albany County
PEDESTRIAN GENERATOR CHECKLIST
DATE: 07/30/12 **PREPARED BY:** LMW **REVIEWED BY:**

Note: The term "generator" in this document refers to both pedestrian generators (where pedestrians originate) and destinations (where pedestrians travel to). A check of yes indicates a potential need to accommodate pedestrians and coordination with the Regional Bicycle and Pedestrian Coordinator is necessary during project scoping. Answers to the following questions should be checked with the local municipality to ensure accuracy.

1.	Is there an existing or planned sidewalk, trail, or pedestrian crossing facility? **Comments: Wolf Rd is part of CDTC's Proposed Priority Bicycle/Pedestrian Network and improving system connectiving between the existing pedestrian/bicycle facilities on Wolf Rd and those constructed as part of the Albany-Shaker/Watervliet-Shaker Rd project is a secondary objecting of the proposed project.**	**YES**☒ **NO**☐
2.	Are there bus stops, transit stations or depots/terminals located in or within 800m of the project area? **Comments: CDTA currently provides service along I-87, Albany-Shaker Rd and Wolf Rd within the project study area.**	**YES**☒ **NO**☐
3.	Is there more than occasional pedestrian activity? Evidence of pedestrian activity may include a worn path. **Comments: Moderate to high pedestrian activitiy was observed along the existing sidewalks within the project corridor. In addition, there is evidence of pedestrian activity on Albany-Shaker Rd west of Wolf Rd.**	**YES**☒ **NO**☐
4.	Are there existing or approved plans for generators of pedestrian activity in or within 800m of the project that promote or have the potential to promote pedestrian traffic in the project area, such as schools, parks, playgrounds, places of employment, places of worship, post offices, municipal buildings, restaurants, shopping centers or other commercial areas, or shared-use paths? **Comments: There are several generators of pedestrain activity within and around the proposed project area. Retail establishments, hotels, the Albany International Airport, office space, Ann Lee Pond Nature and Historic Preserve and the Crossings at Colonie are all located in or adjacent to the project study area and have potential to promote pedestrian activity.**	**YES**☒ **NO**☐
5.	Are there existing or approved plans for seasonal generators of pedestrian activity in or within 800m of the project that promote or have the potential to promote pedestrian traffic in the project area, such as ski resorts, state parks, camps, amusement parks? **Comments: Ann Lee Pond Nature and Historic Preserve, the Crossings at Colonie, and the Shaker Historic site are all located adjacent to the project study are and have potential to promote seasonal pedestrian activity.**	**YES**☐ **NO**☒
6.	Is the project located in a residential area within 800m of existing or planned pedestrian generators such as those listed in #4? **Comments: Residential areas are located along Wolf Rd, Sand Creek Rd, Albany-Shaker Rd, and Watervliet-Shaker Rd. Although there are not many residential areas located within the project study area, several are located adjacent to the project study area within 2,500 ft of the pedestrian generators listed above.**	**YES**☒ **NO**☐
7.	From record plans, were pedestrian facilities removed during a previous highway reconstruction project? **Comments: Pedestrian Facilities have not been removed during previous highway reconstruction projects.**	**YES**☐ **NO**☒
8.	Did a study of secondary impacts indicate that the project promotes or is likely to promote commercial and/or residential development within the intended life cycle of the project? **Comments: The project is not likely to promote commerial and/or residential development within the intended life cycle of the project.**	**YES**☐ **NO**☒
9.	Does the community's comprehensive plan call for development of pedestrian facilities in the area? **Comments: Wolf Road is part of CDTC's Proposed Priority Bicycle / Pedestrian Network and improving system connectivitiy between the existing pedestrian/bicycle facilities on Wolf Rd and the facilities constructed as part of the Albany-Shaker/Watervliet-Shaker Rd project is a secondary objective of the proposed project.**	**YES**☒ **NO**☐
10.	Based on the ability of students to walk and bicycle to school, would the project benefit from engineering measures under the Safe-Routes-To-School-Program? Eligible infrastructure-related improvements must be within a 3.2km radius of the project. **Comments: Several schools within the North and South Colonie Central School Districts are located within 2 miles of the project study area, the immediate project area would not benefit from engineering measures under the Safe-Routes-To-School Program.**	**YES**☐ **NO**☒

ADDITIONAL COMMENTS:
Include comment on exceptional circumstances from EI 04-011 if pedestrian accommodations are warranted but not provided.

***Note**: This checklist should be revisited due to a project delay or if site conditions or local planning changes during the project development process.*